Corporate-to-Sovereign Credit Risk Spillovers: Evidence from Emerging Markets

Di Wang

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Abstract

The existing literature has documented the pass-through of sovereign risk into corporations' financing costs. This paper examines how corporations' credit risks affect those of their sovereigns in nine emerging markets (EMs). I construct a novel data set that combines daily corporate news and credit default swap (CDS) rates on EMs' sovereign and corporate bonds. A high-frequency event-study analysis shows that a 10% post-news increase in corporate CDS rates leads to a 3% rise in sovereign CDS rates within a one-day event window. Being a state-owned enterprise (SOE), or a corporation operating in a government-dependent sector, or a large corporation adds another 3% rise in sovereign CDS rates. Stress in the domestic banking sector also contributes to higher sovereign CDS rates. Among all channels, being an SOE has the most prominent effect. An extreme value analysis further shows that extreme changes in sovereign CDS rates are more likely when CDS rates of its corporations experience extreme changes, even after controlling for common shocks that affect both corporations and sovereigns.

JEL Classification: E44, F34, H63

Keywords: Sovereign Risk, Corporate Debt, Emerging Markets, Credit Default Swap, High-frequency Event-study Analysis

1 Introduction

Sovereign credit risk has always been a concern for emerging markets (EMs). There have been 17 sovereign defaults by 12 EMs since 1999.[1] Although researchers have documented that sovereign credit risk impacts the real sector of the economy, few have studied whether credit risk in the real sector could be a source of sovereign credit risk. According to the Bank for International Settlements, total credit lent to non-financial corporations as a percentage of GDP in EMs substantially increased from 2007 to 2016. The aggregate EM corporate debt-to-GDP ratio has grown by 46 percentage points in that period, compared to 4.9 percentage points in advanced economies. Aggregate EM corporate debt reached 106 percent of their GDP by 2016. Table 1 lists some selected EMs' sovereign credit rating actions related to corporate sector conditions, taken recently by Moody's, one of the major credit rating agencies. The rationale behind these rating actions indicates several possible channels through which corporate credit risk could spill over to the corresponding sovereign credit risk.

[1] The list of sovereign defaults is provided in the Appendix as Table A.1.

Table 1: Selected EMs' Sovereign Credit Rating Actions by Moody's (2011-2016)

Date	Country	Rating Action	Rationale Related to Corporate Sector
11/20/2013	Malaysia	Moody's changes outlook for Malaysia's A3 rating to positive from stable.	We expect limited volatility from these items, including dividends, royalty payments, and taxes sourced from the national oil and gas company, Petroliam Nasional Bhd.
1/16/2015	Russia	Moody's downgrades Russia's government bond rating to Baa3; on review for further downgrade.	Review for future downgrade will examine the extent to which the potential need to provide financial support of the corporate and banking sectors may erode the sovereign's financial strength...and/or increase the use of government guarantees.
8/11/2015	Brazil	Moody's downgrades Brazil's rating to Baa3 from Baa2; outlook changed to stable.	Low capacity utilization, low business confidence, and Petrobras-related developments will negatively affect investment prospects this year and next. Political dynamics are damaging: the lack of political consensus on fiscal reforms have been exacerbated by the events surrounding the Lava Jato investigation and Petrobras-related corruption scandals.
2/24/2016	Brazil	Moody's downgrades Brazil's issuer and bond ratings to Ba2 with a negative outlook.	The downgrade to Ba2 is intended to capture that ongoing deterioration, while the negative outlook contemplates the risks of further deterioration to Brazil's credit profile emanating from macroeconomic shocks...or the need to support government-related entities. Reduced uncertainty about the magnitude of contingent liabilities migrating to the sovereign balance sheet, most likely from Petrobras, could also lead Moody's to stabilize the outlook.
3/2/2016	China	Moody's changes outlook on China's Aa3 government bond rating to negative from stable; affirms Aa3 rating.	The government's balance sheet is exposed to contingent liabilities through regional and local governments, policy banks, and SOEs. The ongoing increase in leverage across the economy and financial system and the stress in the SOE sector imply a rising probability that some of the contingent liabilities will crystallize on the government's balance sheet.
3/31/2016	Mexico	Moody's changes Mexico's outlook to negative from stable; affirms A3 rating.	One key driver of today's rating action is contingent liabilities in the form of possible government support to PEMEX, given liquidity pressures at the state-owned oil producer, could further undermine the fiscal consolidation process.

The first possible channel is that a deterioration in state-owned enterprises (SOEs) or government-dependent sectors can trigger the use of government guarantees and thus become a driver of sovereign credit downgrading.[2] When SOEs or government-dependent companies have difficulty paying back debt and the sovereign assumes the contingent liabilities of SOEs, the costs of the bailout hurt the government's fiscal position and increase its sovereign credit risk.[3] The number of contingent liabilities that may crystallize on governments' balance sheets could be sizable. According to IMF (2015), the share of EMs' corporate debt issued by SOEs increased from nearly zero in 2010 Q1 to more than 40 percent in 2015 Q3.

The second possible channel is that certain corporations are so large that their failure would be a disaster to their government (for example, by causing a substantial decline in tax revenue) or aggregate economic activity. Therefore, government support is needed in times of difficulty, i.e., these firms are "too big to fail." It is also possible that large corporations are systemically important and may have more spillovers to the sovereign, which does not necessarily depend on implicit bailout guarantees for these corporations. Credit risk to systemically important corporations could spill over to the sovereign simply because adverse shocks to large corporations hurt the overall economy and tax revenue.

The third possible channel is through the banking sector. Greater corporate leverage in EMs can make firms less able to withstand adverse shocks to income or

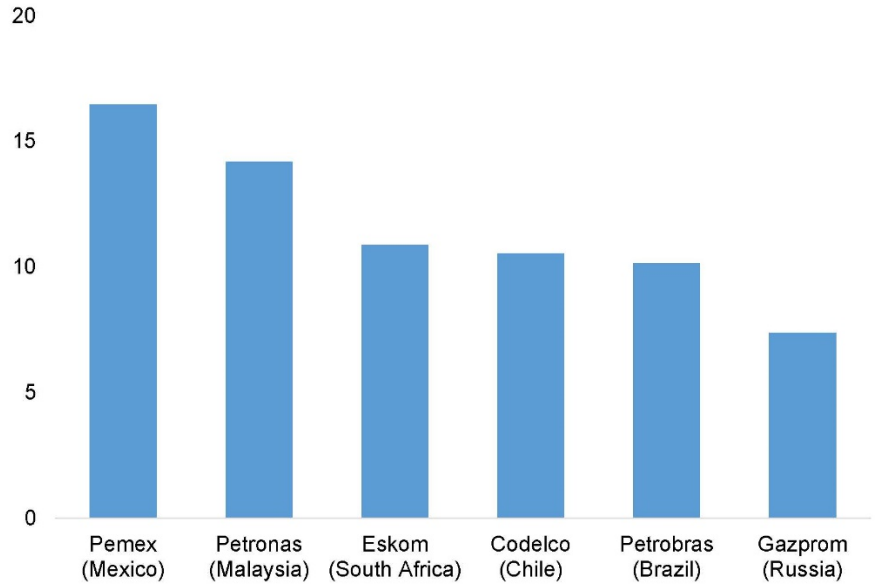
[2] I later measure the government dependence of different sectors by using the method of Pellegrino and Zingales (2017), who capture the degree of government involvement in an industry's media coverage.
[3] SOEs are usually more politically connected than non-SOEs, and Faccio, Masulis, and McConnell (2006) document that politically connected firms are significantly more likely to be bailed out in a crisis than otherwise similar non-connected firms.

asset values. An increased possibility of corporate default could quickly spill over to the banking sector because corporate debt accounts for a significant share of emerging market banks' assets (IMF, 2015). Elevated losses in the banking sector may, in turn, weaken the sovereign's financial strength and induce government bailouts of banks, whose cost increases sovereign credit risk.

In this study, I undertake a systematic examination of corporate credit risk's impact on sovereign credit risk through these three transmission channels. I analyze a set of 9 EMs: Brazil, Chile, China, Malaysia, Mexico, Philippines, Russia, South Africa, and Thailand. This group of countries is particularly interesting because the mechanisms studied in this paper may already be at work in these countries. Most of them have large quasi-sovereign companies that are not only highly indebted, as shown in Figure 1, but are also among the most significant contributors to the GDP growth of their home country. As energy prices turned unfavorable in recent years, these companies found it hard to pay back debt with decreased profits. The probability of government bailouts and banking sector failures rose.

Figure 1: Selected Quasi-Sovereign Company's Debt as Percentage of GDP

Year 2016



Source: Worldscope and IMF.

To measure corporate and sovereign credit risk, I use daily credit default swap (CDS) rates, a market-based risk-neutral measure of default probability.[4] The higher the CDS rate, the greater the market's perceived probability of default. A CDS rate of 300 basis points, for example, implies it would cost $300,000 per year to insure $10 million worth of debt over a particular time frame, typically five years.

There is a critical identification issue in estimating the impact of changes in corporate CDS rates on changes in sovereign CDS rates, and this paper aims to mitigate the issue. A positive correlation between corporate and sovereign CDS rates may

[4] A CDS is a financial derivative in which the seller of the swap agrees to insure the buyer against the possibility that the issuer (sovereign or firm) defaults on its debt. Once a third party, the International Swaps and Derivatives Association (ISDA), declares a credit event, an auction occurs to determine the price of the defaulted debt. The CDS seller then pays the buyer the difference between the face and the auction value of the debt. An important advantage of using CDS data (rather than bond data) is that the CDS market is typically more liquid than the corresponding bond market, resulting in more accurate estimates of credit spreads and returns.

simply demonstrate the substantial pass-through running from sovereign to corporate credit risk, which has been well documented in the literature (as discussed in Section 2). To show empirically that the direction of causality is indeed from corporate to sovereign risk, I use a high-frequency event-study analysis as in Gürkaynak, Sack, and Swanson (2005) to confirm the presence of causality running from corporate to sovereign credit risk. Section 4 also uses an extreme value analysis as in Forbes (2013) to further illustrate the extent of contagion between corporations and sovereigns.

For the high-frequency event-study analysis, I construct a new data set that captures changes in sovereign credit risk in a 24-hour window containing news releases relevant to that country's corporations' credit status, using daily data from 1/1/2014 to 12/29/2016. The use of intra-day data allows better isolation of sovereign risk response to news on corporate risk. The results show that a 10% increase in corporate CDS rates leads to about a 3.0% rise in sovereign CDS rates within a one-day event window. Being an SOE adds another 3.5% rise in sovereign CDS rates. Being a corporation operating in a government-dependent sector adds a further 3.0% rise in sovereign CDS rates. Being a large corporation adds another 2.6% to 3.8% rise in sovereign CDS rates. These estimates are statistically significant. Stress in the domestic banking sector, measured by elevated bank CDS rates and banking sector news releases, also contributes to credit risk spillovers. The regression results with all channels included show that being an SOE has the most prominent effect among all channels.

Additionally, I use an extreme value analysis to assess the contagion effects. I identify the days during the sample period when either the corporation or sovereign has an extreme-positive or extreme-negative change in CDS rates, defined as a change in

the top or bottom 5 or 1 percentile of the distribution of changes in CDS rates. Extreme changes in corporate CDS rates are significantly and positively correlated with the probability of an extreme change in its sovereign CDS rate on the same day. That probability is increased by a factor of up to 16.7 compared to the case of no extreme changes in the corporate CDS rate. Being an SOE or a large corporation contributes to more significant contagion into sovereign credit risk. Although the extreme value analysis cannot identify the direction of causality, it still can shed light on the extent of contagion between corporate and sovereign CDS rates.

The paper has several policy implications. First, because the sovereign-SOE nexus can spread the SOEs' corporate risk to the sovereign and have a systemic impact, policymakers should closely monitor SOEs' financial status, especially highly leveraged SOEs in strategically important sectors. Second, SOEs may overborrow from the perspective of the social planner. There is evidence that higher sovereign credit risk passes down to more expensive financing for other firms in that country (see Section 2). Therefore, there is a pecuniary externality associated with SOE borrowing. When SOEs make borrowing decisions, they do not consider how their actions could affect other firms' financing costs through higher sovereign credit risk. The real borrowing cost for SOEs should include their spillover effect on other firms. Moreover, large SOEs with close government relationships are usually able to get subsidized credit from state-owned banks. They know that governments are likely to bail them out if they default, creating a moral hazard problem. All of these factors contribute to SOEs' overborrowing, and policymakers may want to privatize SOEs to improve social welfare. Similarly, policymakers should also review regulations on large and

interconnected corporations that are “too big to fail.” They should mitigate the moral hazard problem, e.g., by preventing them from deliberately taking high-risk, high-return positions and leveraging such risks based on implicit guarantees.

The remainder of the chapter is organized as follows. Section 2 presents a brief review of the literature. Section 3 provides empirical evidence from the high-frequency event study. Section 4 reports and discusses the main findings of the extreme value analysis. Section 5 concludes.

2 Related Literature

This research is related to several strands of the literature. Many studies have documented a strong link between sovereign and private sector interest rates, both in emerging economies and, more recently, in European countries. Government crises affect aggregate outcomes through firms’ borrowing, creating a financial channel; see Neumeyer and Perri (2005) and Uribe and Yue (2006) for discussion of sovereign crises and business cycles in emerging markets, and Corsetti, Kuester, Meier, and Müller (2013) for discussion of the implications of sovereign risk pass-through for fiscal multipliers. The pass-through of sovereign risk to the private sector has been studied both theoretically and empirically. Bocola (2016) proposes a quantitative model for studying the transmission of sovereign risk to firms’ borrowing costs and real economic activity through financial intermediation. Acharya, Drechsler, and Schnabl (2014) model a loop between sovereign and bank credit risk, in which government bailouts of the financial sector increase sovereign credit risk, which in turn weakens the financial sector by eroding the value of its government guarantees and bond holdings. Arellano, Bai, and Bocola (2019) use a sovereign debt model calibrated to Italian firm- and bank-

level data to measure the effects of an increase in sovereign risk on the private sector. They find that heightened sovereign risk was responsible for one-third of the observed output decline during Italy's 2011-2012 crisis.

On the empirical side, Baskaya and Kalemli-Özcan (2016) investigate the effect of sovereign risk on credit provision, using the August 1999 earthquake as an exogenous shock to Turkey's sovereign default risk. Bedendo and Colla (2015) document that an increase in sovereign credit spreads in the euro area is associated with a significant increase in corporate spreads and firms' borrowing costs. Augustin, Boustanifar, Breckenfelder, and Schnitzler (2018) explore the first Greek bailout to examine the transmission of sovereign risk to corporate credit risk.

The existing literature on sovereign-corporate linkages focuses on causality running from sovereign to corporate risk, while my paper explores causality running in the other direction. Combining these two sides implies a loop between sovereign and corporate credit risk. Increased sovereign credit risk weakens the financial sector and increases the borrowing costs of firms. A distressed corporate sector induces government bailouts, whose costs, in turn, increase sovereign credit risk.

This paper contributes to the understanding of the determinants of sovereign credit risk. Longstaff, Pan, Pedersen, and Singleton (2011) find that 64 percent of sovereign credit risk can be linked to global factors, using a dataset of sovereign CDS contracts of 26 countries. Aizenman, Hutchison, and Jinjarak (2013) show that fiscal space and other macroeconomic factors are statistically and economically significant determinants of sovereign risk for the Eurozone Periphery countries. Dieckmann and Plank (2012) document that the state of a country's financial system and also the state

of the world financial system have strong explanatory power for the behavior of sovereign CDS spreads. Du and Schreger (2017) show that a higher reliance on external foreign currency corporate financing is associated with a higher default risk on sovereign debt denominated in local currency. This paper is the first to empirically show that corporate credit risk is also a determinant of sovereign credit risk using a high-frequency event-study analysis.

This paper also adds to the emerging literature on how microeconomic shocks may transmit fluctuations at the macro level. This literature characterizes the law of motion for the firm size distribution for any *finite* number of firms, so it does not rely on the traditional "continuum of firms" assumption. Gabaix (2011)'s seminal work introduces the "Granular Hypothesis," which states that whenever the firm size distribution is fat-tailed (compared to a normal distribution), idiosyncratic shocks average out at a slow enough rate that they can translate into aggregate fluctuations. Acemoglu, Ozdaglar, and Tahbaz-Salehi (2017) argue that macroeconomic tail risks can have their origins in idiosyncratic microeconomic shocks to disaggregated sectors. Carvalho and Grassi (2019) show that a small number of firms' prominence leaves open the possibility that aggregate outcomes may be affected by large firms' dynamics. They develop a quantitative theory of aggregate fluctuations caused by firm-level disturbances alone. Kwak (2019) shows that rising leverage in large European firms can explain about a third of rising sovereign spreads during the 2020-2012 European debt crisis. My paper complements this literature by focusing on the transmission of *credit risk* from the micro to the macro level for large firms in *emerging markets*.

Finally, this paper is related to the literature on SOEs' impact and government bailouts' real cost. Lin, Cai, and Li (1998) argues that an economy with SOEs is subject to allocative inefficiency because the industrial structure deviates from the pattern dictated by comparative advantage. Faccio, Masulis, and McConnell (2006) analyze the likelihood of government bailouts of 450 politically connected firms from 35 countries and find that politically connected firms are significantly more likely to be bailed out than similar non-connected firms. Jeske, Krueger, and Mitman (2011) evaluate the macroeconomic and distributional effects of government bailout guarantees in the US mortgage market and find that eliminating such a guarantee could substantially increase aggregate welfare. This paper establishes another source of inefficiency resulting from SOEs and government-dependent firms, namely their excessive borrowing and consequently higher borrowing costs for other firms due to elevated sovereign credit risk.

3 High-frequency Event-study Analysis: The Effects of Changes in Corporate Risk on Sovereign Risk

In this section, I investigate the spillover effects of corporate risk changes on sovereign risk using a high-frequency event-study analysis and explore the channels of these spillovers. I construct a new data set that captures changes in sovereign credit risk in a one-day window bracketing news releases relevant to its corporations' credit status from 1/1/2014 to 12/29/2016. The use of daily data allows me to isolate better the response of sovereign risk to news releases on corporate risk. I identify idiosyncratic corporate shocks that are exogenous with respect to sovereign risks. According to the estimates, news on corporate risk has a significant impact on sovereign risk, as

measured by changes in the CDS market rates. Moreover, changes in credit risk of SOEs, corporations in government-dependent sectors, and corporations with a large scale in terms of total assets, total liabilities, or corporate income tax payment have an especially large impact on sovereign risk relative to their counterparts.

3.1 Methodology

I examine how sovereign CDS rates respond to changes in corporate CDS rates within a one-day window after corporate news releases, using the following regression:

$$\Delta Log(sovereign\ CDS)_{jt} = \alpha_j + \delta_t + \beta \Delta Log(corporate\ CDS)_{ijt} + \theta \Delta Log(X_{jt}) + \epsilon_{ijt} \quad \text{Equation 1}$$

where *i*, *j*, and *t* denote corporate, sovereign, and time on a daily basis, respectively.

$\Delta Log(corporate\ CDS)$ denotes the daily log change in the corporate CDS rates on the date of the news release, and $\Delta Log(sovereign\ CDS)$ denotes the daily log change in the sovereign CDS rates for the country where the corporation's headquarters resides. $\Delta Log(X_{jt})$ is the daily log change in a list of country-level control variables, which may drive corporate and sovereign credit risk at the same time. It includes (1) the daily log change in the close price of that sovereign's major stock index; (2) the daily log change in the relevant commodity price associated with each corporation; and (3) the daily log change in that country's exchange rate against the US dollar.[5] [6] α_j

[5] The stock indices adopted for each country are the Ibovespa Brasil Sao Paulo Stock Exchange Index for Brazil; Santiago Stock Exchange General Index for Chile; Shanghai Stock Exchange Composite Index for China; FTSE Bursa Malaysia Kuala Lumpur Composite Index for Malaysia; Índice de Precios y Cotizaciones (IPC) for Mexico; Philippines Stock Exchange PSEi Index for the Philippines; Moscow Exchange MICEX-RTS PJSC for Russia; FTSE/JSE Africa All Share Index for South Africa; and Stock Exchange of Thailand SET Index for Thailand.

[6] Gazprom is associated with natural gas; Codelco with copper; CAP, Companhia Siderúrgica Nacional, Gerdau, Severstal, and Usiminas with steel; ALROSA with diamonds; AngloGold Ashanti with gold; and Vale SA with iron. Other corporates are associated with crude oil.

and δ_t denote country and day fixed effects, respectively. The day fixed effects help capture macroeconomic fundamentals changes that have a common effect on both corporate and sovereign credit risk. ϵ_{ijt} is a stochastic error term that captures the effects of other factors that influence the sovereign CDS rates.

I use a high-frequency event-study analysis to estimate Equation 1. One generally cannot estimate such a model using monthly or quarterly data due to simultaneous equations and omitted variables bias. In particular, the change in corporate CDS rates could be a response to a change in sovereign risk that took place earlier in the month or quarter, due to the direct effects of sovereign risk on corporate borrowing costs. Alternatively, both corporate and sovereign risk could be responding to crucial macroeconomic news (captured by ϵ_{ijt}) that was released earlier in the period, such as US monetary policy shocks. In either case, the classical regression assumption that ϵ_{ijt} is orthogonal to $\Delta Log(corporate\ CDS)_{ijt}$ would be violated.

These problems can be mitigated by using higher-frequency data to focus on the correlation between sovereign and corporate CDS rates during periods around the release of corporate news. I estimate Equation 1 using only daily changes that happen within a narrow window of time after the news releases. I set the event-study window to 24 hours and it becomes unlikely that any other significant events took place within this narrow window that might have influenced both sovereign and corporate risk, thereby reducing omitted variables and simultaneity bias. A similar methodology has been widely used in finance, for example, in the study of the post-earnings-

announcement drift phenomenon, which is the impact of firms' earnings announcements on their stock returns over the next 30 or 60 trading days.[7]

3.2 Data and Summary Statistics

The focus of my study is the impact of corporate credit risk on sovereign risk in emerging markets. To measure credit risk, I collect publicly-traded CDS data from the Markit database. Compared to other CDS data sources such as Bloomberg and Thomas Reuters Datastream, Markit has several advantages. First, it has the most comprehensive coverage, providing *end-of-day* (i.e., 4pm EDT) CDS single name composites on approximately 2,600 entities. On a daily basis, Markit collects more than a million CDS quotes contributed by more than 30 major market participants. The quotes are subject to a curve-based cleaning process that removes outliers and stale observations. Markit then computes a daily composite spread only if it has two or more contributors. Second, Markit is one of the most widely employed CDS databases in finance and economics literature. Papers that employ this dataset include Acharya and Johnson (2007), Jorion and Zhang (2007), Zhang, Zhou, and Zhu (2009), and Hébert and Schreger (2017). I focus on the available universe of corporate and sovereign 5-year CDS markets since the 5-year maturity is most liquid in the CDS market. These CDS are all denominated in US dollars, eliminating confounding pricing effects from exchange rates in CDS rates.

I apply several filters to the CDS data to mitigate bias from missing or stale data, following the existing literature (Bedendo and Colla, 2015; Berndt and Obreja,

[7] See Bernard and Thomas (1989) as an example.

2010; Schneider, Sögner, and Veža, 2010). First, I exclude CDS for which the longest series of consecutive missing rates are more than two weeks. Second, I exclude CDS for which the percentage of missing data exceeds 15% of the whole period, which amounts to 117 missing rates. Third, I exclude stale observations with zero changes in either sovereign or corporate CDS rates. Finally, I require every country included in the sample to have a minimum of four companies. I exclude Colombia, Hungary, Indonesia, Poland, and Turkey because of this restriction on CDS transaction sufficiency. I identify 9 EMs with sufficient publicly-traded CDS data in the corporate, sovereign, and banking sectors. They are Brazil, Chile, China, Malaysia, Mexico, Philippines, Russia, South Africa, and Thailand.

After CDS data cleaning, I collect news releases concerning credit risk on the corporations in my CDS sample over the period from 1/1/2014 to 12/29/2016. To avoid "cherry-picking," I search for news releases through Dow Jones' Factiva News Search database, commonly used in event studies. This database covers business news articles from over 8,000 sources, including national and international newspapers, magazines, wire services, websites, and industry (trade) sources. I use corporate names as the identifier and collect their news releases under four categories related to credit risk: corporate actions, financial performance, corporate financial difficulty, and corporate funding. By combining the two data sources, I identify 61 corporations in the 9 EMs mentioned above. For the main analysis, I use a one-day event window. Consider a news release at 2pm EDT on Wednesday, November 9, 2016. The one-day event window, applied to this event, would imply examining the CDS rate change from the close on Tuesday, November 8 to the close on Wednesday, November 9. If the news is

released after 4pm EDT (i.e., after the market closes), it would be treated as news released early morning on Wednesday, November 9. I also check the robustness of my results using a two-day event window.

To screen out corporate shocks that might be correlated with sovereign or aggregate shocks, I exclude event days when there are sovereign credit rating actions or commentaries released from three major credit rating agencies: Standard & Poor's (S&P), Moody's, and Fitch Group. A total of 2,300 observations out of 36,992 are dropped from the sample for this reason. Table A.2 summarizes detailed information on the corporations included in the sample. They operate in 7 sectors defined by Markit: basic materials, consumer goods, consumer services, energy, industrials, telecommunications, and utilities. I match the data on corporate CDS rates to the CDS rates on sovereigns for the countries in which the corporations' headquarters reside. I drop observations with missing corporate or sovereign CDS data.

The final sample consists of 10,201 observations for 61 corporations in 9 EMs. Table 2 presents the descriptive statistics for the final sample, broken down by each sovereign. Overall, there are substantial variations in both corporate and sovereign CDS rates within and across countries. Russia and Brazil are the most represented countries, comprising about 36% and 20% of the sample, respectively. Other countries have reasonably large shares in the sample as well.[8]

[8] For comparison, summary statistics for all dates, including dates without major corporate news releases and dates with sovereign risk announcements, are reported in Table A.4 in the Appendix.

Table 2: Summary Statistics for High-frequency Event-study Analysis

	Obs.	Mean	SD	Min.	Med.	Max.	Skew.	Kurt.
Whole Sample								
$\Delta Log(corporate\ CDS)$	10201	-0.002	0.042	-1.716	-0.001	0.832	-8.508	348.9
$\Delta Log(sovereign\ CDS)$	10201	0.003	0.032	-0.163	0.003	0.192	0.167	5.831
$\Delta Log(stock\ index)$	9107	0.000	0.018	-0.112	0.000	0.125	-0.053	7.759
$\Delta Log(commodity\ price)$	10201	-0.001	0.030	-0.847	0.000	0.378	-5.873	191.4
$\Delta Log(exchange\ rate)$	9986	0.001	0.012	-0.129	0.000	0.109	0.328	22.15
Brazil								
No. of news per corp.	-	232	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	2089	-0.002	0.054	-0.780	-0.001	0.832	-2.678	110.8
$\Delta Log(sovereign\ CDS)$	2089	0.004	0.032	-0.133	0.004	0.138	0.168	5.366
Chile								
No. of news per corp.	-	69	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	481	0.000	0.024	-0.089	0.000	0.348	6.249	91.78
$\Delta Log(sovereign\ CDS)$	481	0.005	0.032	-0.102	0.005	0.109	0.140	4.508
China								
No. of news per corp.	-	120	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	838	-0.005	0.068	-1.716	-0.000	0.250	-19.25	489.0
$\Delta Log(sovereign\ CDS)$	838	0.005	0.025	-0.079	0.003	0.116	0.512	4.581
Malaysia								
No. of news per corp.	-	113	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	792	-0.002	0.030	-0.091	-0.004	0.155	0.653	5.163
$\Delta Log(sovereign\ CDS)$	792	0.001	0.029	-0.088	0.000	0.162	0.606	5.794
Mexico								
No. of news per corp.	-	151	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	1056	-0.001	0.025	-0.116	-0.002	0.146	0.484	5.679
$\Delta Log(sovereign\ CDS)$	1056	0.003	0.033	-0.112	0.002	0.147	0.175	4.253
Philippines								
No. of news per corp.	-	95	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	378	-0.010	0.073	-0.497	-0.002	0.298	-2.560	20.11
$\Delta Log(sovereign\ CDS)$	378	0.004	0.025	-0.052	0.003	0.096	0.478	3.911
Russia								
No. of news per corp.	-	366	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	3660	-0.002	0.030	-0.462	-0.000	0.353	-0.815	34.99
$\Delta Log(sovereign\ CDS)$	3660	0.001	0.035	-0.163	0.003	0.192	0.078	6.164
South Africa								
No. of news per corp.	-	102	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	510	-0.004	0.037	-0.390	-0.001	0.197	-2.709	34.89
$\Delta Log(sovereign\ CDS)$	510	0.004	0.024	-0.070	0.003	0.092	0.247	3.900
Thailand								
No. of news per corp.	-	79	-	-	-	-	-	-
$\Delta Log(corporate\ CDS)$	397	-0.004	0.029	-0.151	-0.002	0.211	0.209	13.03
$\Delta Log(sovereign\ CDS)$	397	0.002	0.023	-0.073	0.001	0.104	0.644	5.860

Note: CDS data cover dates that have news releases from 1/1/2014 to 12/29/2016. $\Delta Log(corporate\ CDS)$ and $\Delta Log(sovereign\ CDS)$ are the daily log change in corporate CDS rates and sovereign CDS rates, respectively. $\Delta Log(stock\ index)$ is the daily log change in the closing price of a country's major stock index. $\Delta Log(commodity\ price)$ is the daily log change in the relevant commodity

price associated with each corporation. $\Delta Log(exchange\ rate)$ is the daily log change in the country's foreign exchange rate against the US dollar.
Source: CDS data are from Markit. Stock index data are from Bloomberg. Commodity prices and exchange rates are from Thomas Reuters Datastream.

3.3 Discussion of Main Results

In Section 3.3.1, I present and analyze the estimates of spillovers from corporate to sovereign credit risk. In Section 3.3.2, I discuss three possible channels through which corporate credit risk may transmit to sovereign credit risk.

3.3.1 Corporate to Sovereign Credit Risk Spillovers

Table 3 presents the results from estimating the baseline regression Equation 1. The independent variable is the daily log change in the sovereign CDS rate, and the sample consists of dates when there are news releases concerning corporate credit risk. Column (1) includes only the log change in corporate CDS rates and time fixed effects as independent variables, while column (2) adds country fixed effects. The coefficient on corporate CDS rates has the expected positive sign and is statistically significant. Next, I add changes in stock prices, relevant commodity prices, and exchange rates against the USD. Results in columns (7) and (8) indicate that, on average, a surprise 10% increase in corporate CDS rates due to negative news leads to about a 3.0% increase in sovereign CDS rates, and these estimates are statistically significant. This extent of risk transfer is also economically significant. A one-standard-deviation increase in corporate CDS rates (0.042) corresponds to an increase in sovereign CDS rates of 0.39 standard deviations ((0.297 × 0.042)/0.032 = 0.39, see Table 2).

These results provide empirical support to models suggesting that idiosyncratic firm-level shocks can explain part of aggregate fluctuations and provide a micro-

foundation for aggregate shocks (Gabaix, 2011; Acemoglu, Ozdaglar, and Tahbaz-Salehi, 2017; Carvalho and Grassi, 2019). I include day fixed effects in all model specifications to control for any common macroeconomic factors. The comparison of estimations with and without country fixed effects shows that my results are robust against controlling for unobservable and time-invariant country-specific factors. I correct all standard errors for possible heteroskedasticity and auto-correlation by adopting Newey-West variance estimates.[9]

The coefficients of the control variables also have the expected signs and are statistically significant. An increase in stock prices, an indicator of better expectations about future economic activity, lowers sovereign risk. Declining commodity prices push up sovereign risk since they erode the sovereign's tax revenue. Finally, an increased exchange rate (i.e., depreciation against the US dollar) makes paying down sovereign debt denominated in the US dollar considerably more expensive, thus elevating that emerging market's sovereign risk.

[9] Details about the Newey-West standard errors can be found in Newey and West (1987).

Table 3: High-frequency Event-study Analysis - Baseline Regression Results

Dependent variable: $\Delta Log(sovereign\ CDS)_{jt}$

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta Log(corporate\ CDS)_{ijt}$	0.335***	0.335***	0.309***	0.307***	0.305***	0.303***	0.298***	0.297***
	(5.54)	(5.58)	(4.95)	(4.97)	(4.95)	(4.97)	(4.93)	(4.95)
$\Delta Log(stock\ index)_{jt}$			-0.533***	-0.542***	-0.520***	-0.529***	-0.505***	-0.513***
			(-16.52)	(-16.96)	(-16.34)	(-16.76)	(-16.54)	(-17.01)
$\Delta Log(commodity\ price)_{jt}$					-0.095***	-0.096***	-0.093***	-0.093***
					(-5.88)	(-5.81)	(-6.13)	(-6.06)
$\Delta Log(exchange\ rate)_{jt}$							0.271***	0.268***
							(7.86)	(7.90)
Country FE	N	Y	N	Y	N	Y	N	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	10,201	10,201	9,107	9,107	9,107	9,107	9,107	9,107

Note: t statistics are reported in parentheses. Standard errors are "Newey-West" heteroskedastic- and autocorrelation-consistent (HAC) standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively

3.3.2 Discussion of Risk Transmission Channels

Having established that there indeed exist credit risk spillovers from the corporate sector to sovereigns, I next explore the channels through which such spillovers could occur. I highlight possible mechanisms in this section. First, I investigate the fiscal channel by testing whether corporations' credit risk with stronger ties to their domestic government affects their sovereign credit risk more. Second, I explore the size channel by testing whether big corporations, in terms of total assets, total liabilities, and corporate income tax payments, affect sovereign credit risk more. Third, I examine the financial channel by testing whether stressed domestic banks transfer additional credit risk to their sovereigns.

The fiscal channel. One channel for how non-financial corporations may transmit credit risk to their sovereigns could be that the sovereigns have such substantial ownership in these corporations that governments implicitly guarantee their debt to prevent them from falling. A distressed SOE sector increases the probability that some of its contingent liabilities will crystallize on the government's balance sheet. The amount of the implicit government guarantee could be sizable: Jin, Wang, and Zhang (2018) exploit the first default by a large SOE, Baoding Tianwei, in China's onshore bond market and find that implicit government guarantees account for at least 1.75% of bond value. Government guarantees in EMs are not uncommon as well. Table A.5 in the Appendix lists some recent examples of government bailouts of SOEs. In addition to the SOEs, corporations that operate in sectors where governments are influential in the purchasing or regulatory process may have close ties to the government and may be eligible for implicit government guarantees. Faccio, Masulis,

and McConnell (2006) document that politically connected firms are significantly more likely to be bailed out in a crisis than otherwise similar non-connected firms.

To test these two hypotheses, I construct two dummy variables and interact each with corporate CDS shocks. The first dummy variable is state ownership at the firm level, SOE_i, and is time-invariant throughout my sample period. I would expect that adverse credit shocks to SOEs would increase sovereign credit risk to a larger extent than for non-SOEs. I collect corporations' most recent ultimate state ownership information from their official websites and the Worldscope database (see Table A.2).[10] The pairwise correlation between corporate and sovereign CDS rates among SOEs (defined using 100% ultimate state ownership) is 0.96, while that of non-SOEs is 0.89, suggesting that sovereign credit risk moves more closely with SOE than non-SOE credit risk. Motivated by this finding, I run the following regression:

$$\Delta Log(sovereign\ CDS)_{jt} = \alpha_j + \delta_t + \beta \Delta Log(corporate\ CDS)_{ijt} + \gamma \cdot SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt} + \theta \Delta Log(X_{jt}) + \epsilon_{ijt} \quad \text{Equation 2}$$

where *i*, *j*, and *t* denote corporate, sovereign, and time on a daily basis, respectively.

In this subsection, I focus on estimates of Equation 2 using a cutoff of 100% ultimate state ownership: the SOE_i dummy takes on the value one if the corporation's state entity ultimately holds 100% of this corporation's stock, and zero otherwise. Other cutoffs are used in robustness tests. Ten out of 61 corporations in my sample have 100%

[10] Ultimate ownership is different from direct ownership in that ultimate ownership traces the control chains of related companies. For example, suppose Company A is wholly owned by Company B, and 50% of Company B's stock certificates are directly held by its sovereign entity in its name. Then the direct state ownership of company A is zero, while the ultimate ownership is 50%. Compared to direct state ownership, ultimate state ownership more precisely reflects the government's control over an SOE. My results are robust to using direct state ownership.

ultimate state ownership (see Table A.2). The interaction term $SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt}$ aims to capture the extra spillover effect from corporate risk to sovereign risk through the government's implicit guarantees.

In addition to the *SOE* dummy at the firm level, I construct a time-invariant "government dependence" variable, varying across both sectors and countries, following Pellegrino and Zingales (2017). The variable measures how much each sector is dependent on government contracts, regulations, and interventions. The story behind this measure is that corporations in more government-dependent sectors are more likely to maintain a close relationship with their government, thus becoming more "politically connected." According to Faccio, Masulis, and McConnell (2006), politically connected firms are significantly more likely to be bailed out in a crisis than otherwise similar non-connected firms. To construct this variable, I count news articles by sector and by country from Factiva, using its industry tags. The sectors of firms in my sample are matched with Factiva's 17 industry tags.[11] The variable "government dependence" is defined, for each sector q in country j, as the ratio of the number of news articles having "Government Contracts" or "Regulation/Government Policy" as their topics, to the total number of news articles for sector q. I consider all news outlets covered by Factiva over the period from 1/1/2014 to 12/29/2016. Table A.6 reports summary statistics for the "government dependence" variable.

Suppose a sector has a "government dependence" value higher than the 75th percentile of sectors in that country's sample. In that case, it is considered as

[11] Factiva's industry tags are Agriculture, Automotive, Basic Materials/Resources, Business/Consumer Services, Consumer Goods, Energy, Financial Services, Health Care/Life Sciences, Industrial Goods, Leisure/Arts/Hospitality, Media/Entertainment, Real Estate/Construction, Retail/Wholesale, Technology, Telecommunication Services, Transportation/Logistics, and Utilities.

"government-dependent," and I create an indicator variable "*GOV*" that equals one for government-dependent sector-country pairs and zero otherwise. Table A.7 reports the government-dependent sectors for each country. Similar to the regression using the *SOE* dummy, I interact *GOV* with my original corporate CDS variable to investigate if corporations in government-dependent sectors affect their sovereign's credit risk more strongly:

$$\Delta Log(sovereign\ CDS)_{jt} = \alpha_j + \delta_t + \beta \Delta Log(corporate\ CDS)_{iqjt} + \zeta \cdot GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt} + \theta \Delta Log(X_{jt}) + \epsilon_{iqjt} \quad \text{Equation 3}$$

where *i*, *q*, *j*, and *t* denote corporate, sector, sovereign, and time on a daily basis, respectively.

The interaction term $GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt}$ captures the extra spillover effect from corporate risk to sovereign risk through the dependence of government business.

Columns (1) and (2) of Table 4 present the results from estimating Equation 2 and Equation 3, which include the interactions of corporate risk and indicators of dependence on the government. The results in column (1) support my hypothesis on SOEs, with a statistically significant difference at the 1% level between SOEs and non-SOEs' impact on sovereign risk. The coefficient suggests that a 10% increase in non-SOE corporate CDS rates leads to a 2.7% rise in sovereign CDS within a one-day event window while being an SOE adds another 3.5% rise in sovereign CDS rates. Among publicly traded corporations included in the sample, higher ultimate state ownership

contributes to a more significant spillover between corporate and sovereign risk. Results defining SOEs based on direct state ownership are quantitatively very similar.

Meanwhile, the "GOV" interaction term's coefficient is statistically significant as well, as shown in column (2). The results indicate that being in a government-dependent sector and having closer political connections contributes more to the spillover effect, causing an additional 3.0% rise in sovereign CDS rates.

The size channel. The second transmission mechanism is that some firms are "too big to fail". Certain corporations are so large that their failure would be a disaster to the government or aggregate economic activity so that the government is likely to support them in periods of difficulty. Corporations benefit from such protective policies not because of their direct relationship with government, like SOEs, but because they are large enough to be systemically important. Their failures may cause a substantial decline in tax revenue or aggregate output, either way leading to higher sovereign credit risk. Additionally, systemically important firms may have more spillovers to the sovereign simply because adverse shocks to large firms hurt the overall economy and tax revenue even if there are never bailouts.

To test this hypothesis, I match corporate CDS data with firm-level annual balance sheet data from Worldscope and construct three firm-level "*SIZE*" dummy variables to measure the relative size of a corporation in the sample: "*ASST*", "*LIAB*", and "*TAX*". "*ASST*" is an indicator set equal to one if a corporation's average total assets across 2014 to 2016 has a higher than 75^{th} percentile level of total assets among all corporations in that country sample, and zero otherwise. Similarly, "*LIAB*" and "*TAX*" are assigned to one or zero based on a corporation's levels of total liabilities and

corporate income tax payments, respectively. I interact these *SIZE* dummies with my original corporate CDS variable to investigate if relatively larger corporations affect their sovereign's credit risk more strongly:

$$\Delta Log(sovereign\ CDS)_{jt} = \alpha_j + \delta_t + \beta \Delta Log(corporate\ CDS)_{ijt} + \eta \cdot SIZE_i \cdot \Delta Log(corporate\ CDS)_{ijt} + \theta \Delta Log(X_{jt}) + \epsilon_{ijt} \quad \text{Equation 4}$$

where *i*, *j*, and *t* denote corporate, sovereign, and time on a daily basis, respectively.

As presented in columns (3) - (5) of Table 4, large corporations' credit risk significantly impacts their sovereign credit risk more than that of smaller corporations. Being a corporation with total assets in its country's top quartile leads to an additional 3.8% rise in sovereign CDS rates when corporate CDS rates increase by 10%. If I measure a corporation's size by total liabilities or corporate income tax payments, being large (i.e., in the top quartile of its country sample) leads to about an additional 3.5% and 2.6% rise in sovereign CDS rates, respectively. In the robustness tests, I also use the 50th percentiles (median) as the cutoff of a corporation being large or not. The results are no longer significant (see Table 8). This comparison indicates that corporations need to be very large to have such an extra spillover effect on their sovereigns.

The financial channel. The third possible risk transmission mechanism is through the banking sector. In countries where banks hold a considerable amount of local corporate debt, banks could experience stress or even bankruptcy when their corresponding corporate borrowers have difficulty paying back loans. Sovereign credit risk may be elevated because of a stressed banking sector, especially if there are

potential banks' bailouts. Therefore, this indirect corporate-bank- sovereign channel could amplify the adverse effects of the direct corporate-sovereign spillover.

To test this hypothesis, I collect the CDS rates on banks headquartered in each sovereign. I identify a total of 53 banks with publicly traded CDS (see Table A.3). I do not have enough information to identify relationships between specific banks and corporations (e.g., taking loans and selling bonds). Therefore, I match the equal-weighted average of CDS for banks headquartered in that sovereign to the CDS rates of corporations headquartered in the same sovereign. I drop observations with missing bank CDS data. Then, I use bank names as the identifier and collect their news releases related to the financial market from the Factiva News Search database. I construct a dummy variable at the country level, *"BANK"*, which takes the value of one if any sample banks in that country have news release on that date, and zero otherwise. I then interact this *BANK* dummy with my bank CDS variable and add the interaction term to the baseline model Equation 1 to investigate if stressed banking sectors amplify the spillovers from corporate to sovereign risk:

where *i*, *j*, and *t* denote corporate, sovereign, and time on a daily basis, respectively.

Column (6) of Table 4 presents the regression results. The interaction terms' coefficients are statistically significant with positive signs, suggesting that a stressed banking sector indeed amplifies the spillover effects.

$$\Delta Log(sovereign\ CDS)_{jt} = \alpha_j + \delta_t + \beta \Delta Log(corporate\ CDS)_{ijt} + \kappa \cdot BANK_{jt} \cdot \Delta Log(bank\ CDS)_{jt} + \lambda \cdot \Delta Log(bank\ CDS)_{jt} + \theta \Delta Log(X_{jt}) + \epsilon_{ijt} \quad \text{Equation 5}$$

I also construct two country-level financial development measures and test whether a more developed banking sector in emerging markets can mitigate spillovers to some extent. The first measure, DEP_j, is a proxy for a country's dependence on banks. Following Levine (2002) and Augustin et al. (2018), I construct this measure by taking the ratio of each country's aggregate private sector bank deposits to the country's stock market capitalization. A ratio higher than one suggests that the country's financial system is bank-based. I obtain data from the Financial Structure Database published by the World Bank. The second measure, CRE_j, aims to capture the importance of a country's banking sector to the corporate sector. I use data from the Bank for International Settlements (BIS) and calculate bank credit to the private non-financial sector as a percentage of total credit to each country's private non-financial sector. I first calculate these two measures at an annual frequency and then average them over 2014 to 2016 for a given country to get a long-run sense of how much businesses in a country rely on banks rather than the market for financing. Table A.8 in the appendix shows their summary statistics.[12] [13]

[12] No data on CRE is available for the Philippines.

[13] According to BIS' definitions, credit covers loans and debt securities; the private non-financial sector includes non-financial corporations (both private-owned and public-owned), households and non-profit institutions serving households as defined in the System of National Accounts 2008. BIS has no data covering only non-financial corporations for emerging markets. The indicators used here are the closest ones I am able to find to approximately capture the exposure of a country's banking sector to the corporate sector.

Table 4: High-frequency Event-study Analysis – Risk Transmission Mechanisms

Dependent variable: $\Delta Log(sovereign\ CDS)_{jt}$

	State Own. (firm-level)	Gov. Dep. (sector-level)	Total Assets (firm-level)	Total Liab. (firm-level)	Taxation (firm-level)	Bank Stress (country-level)
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Log(corporate\ CDS)_{ijt}$	0.268***	0.286***	0.198***	0.199***	0.221***	0.293***
	(4.60)	(4.78)	(3.83)	(3.74)	(3.70)	(4.66)
$SOE_i \cdot \Delta Log(corporate\ CDS)_{iqjt}$	0.352***					
	(3.55)					
$GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt}$		0.297**				
		(2.27)				
$ASST_i \cdot \Delta Log(corporate\ CDS)_{ijt}$			0.376***			
			(6.04)			
$LIAB_i \cdot \Delta Log(corporate\ CDS)_{ijt}$				0.352***		
				(5.28)		
$TAX_i \cdot \Delta Log(corporate\ CDS)_{ijt}$					0.261***	
					(3.23)	
$BANK_{jt} \cdot \Delta Log(bank\ CDS)_{jt}$						0.046**
						(2.12)
$\Delta Log(bank\ CDS)_{jt}$						0.094***
						(11.15)
$\Delta Log(stock\ index)_{jt}$	-0.508***	-0.510***	-0.479***	-0.484***	-0.493***	-0.486***
	(-18.06)	(-17.46)	(-20.23)	(-19.81)	(-19.13)	(-16.67)
$\Delta Log(commodity\ price)_{jt}$	-0.088***	-0.092***	-0.084***	-0.080***	-0.090***	-0.090***
	(-6.02)	(-6.08)	(-6.37)	(-5.91)	(-6.28)	(-5.98)
$\Delta Log(exchange\ rate)_{jt}$	0.253***	0.267***	0.242***	0.237***	0.257***	0.255***
	(7.98)	(8.02)	(8.41)	(8.21)	(8.32)	(7.81)
Country FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	9,107	9,107	9,107	9,107	9,107	8,988

Note: Column (1) interacts corporate CDS with SOE, a dummy for whether the corporation has 100% ultimate state ownership, and column (2) includes country fixed effects. Column (2) interacts corporate CDS with a dummy variable *GOV*, which takes a value of one if a corporation operates in a sector with a "government dependence" value higher than the 75th percentile of sectors in the country sample, and zero otherwise. Column (3) interacts corporate CDS with *ASST*, a dummy for whether the corporation has total assets higher than the 75th percentile of its country level. Column (4) interacts corporate CDS with *LIAB*, a dummy for whether the corporation has total liabilities higher than the 75th percentile of its country level. Column (5) interacts corporate CDS with *TAX*, a dummy for whether the corporation has total taxation higher than the 75th percentile of its country level. Column (6) interacts bank CDS with a dummy variable *BANK*, which takes a value of one if country *j* on date *t* experiences a news release on any of the banks included in the sample and zero otherwise. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

As I did with the fiscal channel, I interact these two measures with the original corporate CDS variable to investigate the hypothesized mitigating effect of financial development on spillovers. Table A.9 in the appendix shows that the interaction terms' coefficients are statistically significant with negative signs, suggesting that a larger banking sector compared to financial markets mitigate spillover effects to some extent.

Relative Strength of Three Channels. I run the following regression, which includes all interaction terms for the three channels. The standard beta coefficients are reported, so the relative strength of three channels can be directly compared.

$$\begin{aligned}\Delta Log(sovereign\ CDS)_{jt} = {} & \alpha_j + \delta_t + \beta \Delta Log(corporate\ CDS)_{ijt} \\ & + \gamma_1 \cdot SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt} \\ & + \gamma_2 \cdot GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt} \\ & + \gamma_3 \cdot SIZE_i \cdot \Delta Log(corporate\ CDS)_{ijt} \\ & + \gamma_4 \cdot BANK_{jt} \cdot \Delta Log(bank\ CDS)_{jt} \\ & + \lambda \Delta Log(bank\ CDS)_{jt} + \theta \Delta Log(X_{jt}) + \epsilon_{ijt}\end{aligned} \qquad \text{Equation 6}$$

where *i*, *j*, and *t* denote corporate, sovereign, and time on a daily basis, respectively.

Table 5 presents the regression results with standard beta coefficients. Standardized beta coefficients show how many standard-deviation changes in the

dependent variable with every change of one standard deviation in an independent variable. They make results comparable across different independent variables.

The results first show that, among three transmission channels, the fiscal channel working through state ownership is the most prominent, indicating that being an SOE is most influential on sovereign credit risk among all firm characteristics. It is consistent with the rationale of credit rating actions against EM sovereign debt by major credit rating agencies (see Table 1 for selected examples). Secondly, being a large corporation measured by its total assets and total liabilities also significantly impacts changes in sovereign CDS rates. A stressed banking sector has a weakly impact on sovereign credit risk. Thirdly, either being in a government-dependent sector or a large corporation measure by income tax payment does not significantly elevate sovereign credit risk; other firm characteristics may absorb their influence.

Table 5: Relative Strength of Three Transmission Channels

Dependent variable: $\Delta Log(sovereign\ CDS)_{jt}$

Independent variable	(1)	(2)
$\Delta Log(corporate\ CDS)_{ijt}$	0.210***	0.205***
	(3.22)	(3.19)
$SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.201***	0.203***
	(19.27)	(19.44)
$GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt}$	0.006	0.006
	(0.19)	(0.19)
$ASST_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.102***	0.099***
	(2.67)	(2.64)
$LIAB_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.134***	0.136***
	(3.72)	(3.77)
$TAX_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.063	0.062
	(1.32)	(1.32)
$BANK_{jt} \cdot \Delta Log(bank\ CDS)_{jt}$	0.017	0.019*
	(1.59)	(1.72)
$\Delta Log(bank\ CDS)_{jt}$	0.155***	0.152***
	(11.72)	(11.65)
$\Delta Log(stock\ index)_{jt}$	-0.214***	-0.217***
	(-17.30)	(-17.82)
$\Delta Log(commodity\ price)_{jt}$	-0.060***	-0.058***
	(-5.98)	(-5.70)
$\Delta Log(exchange\ rate)_{jt}$	0.088***	0.083***
	(8.42)	(8.08)
Country FE	N	Y
Time FE	Y	Y
Observations	8,988	8,988

Note: standard beta coefficients are reported. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

3.4 Robustness Tests

In this section, I conduct several tests to check the robustness of my results. First, I run regressions with different state ownership and size cutoffs. Second, I run a falsification regression using lagged daily log changes in sovereign CDS rates as the dependent variable. Third, I run regressions with a two-day event window. My main results on the spillover effect from corporate to sovereign risk are robust against these specifications.

Different SOE Cutoffs. Besides using 100% ultimate state ownership as the cutoff for defining an SOE, I also try 30%, 50%, and 80% cutoffs to see whether corporations' state ownership needs to be as high as 100% to have an extra spillover effect on sovereign credit risk. As reported in Table 6, regression results show that the credit risk of corporations with more than 80% ultimate state ownership also spills over more to sovereign credit risk than corporations with ultimate state ownership lower than 80%. However, the extra spillover size is smaller compared to the case using 100% ultimate state ownership (0.280 vs. 0.352). Meanwhile, regressions using 30% and 50% cutoffs do not yield significant coefficients of the SOE interaction term, suggesting that lower levels of ultimate state ownership do not lead to the perception of implicit government guarantees and consequent elevated sovereign credit risk.

Table 6: Main Regression Results - Different SOE Cutoffs

	30%	50%	80%	100%
Independent variable	(1)	(2)	(3)	(4)
$\Delta Log(corporate\ CDS)_{ijt}$	0.193***	0.259***	0.271***	0.268***
	(6.07)	(6.59)	(4.55)	(4.60)
$SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.217	0.091	0.280***	0.352***
	(1.41)	(0.60)	(3.02)	(3.55)
$\Delta Log(stock\ index)_{jt}$	-0.494***	-0.509***	-0.509***	-0.508***
	(-11.32)	(-14.24)	(-17.96)	(-18.06)
$\Delta Log(commodity\ price)_{jt}$	-0.090***	-0.093***	-0.090***	-0.088***
	(-5.49)	(-5.96)	(-6.06)	(-6.02)
$\Delta Log(exchange\ rate)_{jt}$	0.259***	0.265***	0.256***	0.253***
	(6.39)	(6.92)	(8.06)	(7.98)
Country FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Observations	9,107	9,107	9,107	9,107

Note: columns (1) – (3) interact corporate CDS with SOE_{30}, SOE_{50}, SOE_{80}, which indicate whether the corporation has state ownership strictly higher than 30%, 50%, and 80%, respectively. Column (4) repeats, as a comparison, the baseline results where corporate CDS is interacted with *SOE* using 100% state ownership as the cutoff. T statistics are reported in parentheses. Standard errors are "Newey-West" heteroskedastic- and autocorrelation-consistent (HAC) standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Different "Government-Dependent" Sector Cutoff. Besides using the 75th percentile to define "government-dependent" sectors, I also use the 50th percentile (i.e., median) as a cutoff to define the dummy variable *GOV*. GOV_{50} equals one if a corporation operates in a sector with a higher than the *median* level of the "government dependence" variable among all sectors in that country, and zero otherwise. Regression results are reported in Table 7. Contrary to the results shown in columns (3) and (4) of Table 4, interaction terms' coefficients are no longer significant. It indicates that a sector's "government dependence" indicator has to reach at least the top quartile among all sectors in a country to be substantial enough to cause extra corporate-sovereign spillovers.

Table 7: Main Regression Results - Different "Government Dependence" Cutoffs

Dependent variable: $\Delta Log(sovereign\ CDS)_{jt}$

	50th percentile	75th percentile
Independent variable	(1)	(2)
$\Delta Log(corporate\ CDS)_{iqjt}$	0.283***	0.288***
	(3.96)	(4.68)
$GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt}$	0.069	0.304**
	(0.78)	(2.15)
$\Delta Log(stock\ index)_{jt}$	-0.511***	-0.508***
	(-17.82)	(-16.92)
$\Delta Log(commodity\ price)_{jt}$	-0.092***	-0.090***
	(-6.11)	(-5.83)
$\Delta Log(exchange\ rate)_{jt}$	0.266***	0.264***
	(8.14)	(7.99)
Country FE	Y	Y
Time FE	Y	Y
Observations	9,107	9,107

Note: columns (1) and (2) interact corporate CDS with a dummy variable *GOV*, which takes a value of one if a corporation operates in a sector that has a "government dependence" value higher than the 50th and 75th percentile of sectors in the country sample, and zero otherwise, respectively. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Different Size Cutoff. Besides using the 75th percentile to define a corporation as large or not, I also use the 50th percentile (i.e., median) as a cutoff. Table 8 presents results when I interact corporate CDS with "*ASST*", "*LIAB*", and "*TAX*", which are dummies for whether the corporation has total assets, total liabilities, and corporate income tax payments higher than the 50th percentile of the sample corporations in that country, respectively. Corporations with total assets larger than their country median spill over additional credit risk to their sovereigns. However, corporations with total liabilities or corporate income tax larger than their country's median level do not show an additional spillover effect. The results suggest that corporations' borrowing or contribution to government tax revenue has to reach at least the top quartile to be considered systemically important to the sovereign.

Table 8: Main Regression Results - Different Size Cutoffs

Dependent variable: $\Delta Log(sovereign\ CDS)_{jt}$

	Total Assets		Total Liabilities		Taxation	
	50^{th} percentile	75^{th} percentile	50^{th} percentile	75^{th} percentile	50^{th} percentile	75^{th} percentile
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Log(corporate\ CDS)_{ijt}$	0.112***	0.198***	0.196***	0.199***	0.228***	0.221***
	(3.10)	(3.83)	(6.59)	(3.74)	(4.93)	(3.70)
$ASST_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.413***	0.376***				
	(7.31)	(6.04)				
$LIAB_i \cdot \Delta Log(corporate\ CDS)_{ijt}$			0.157	0.352***		
			(1.47)	(5.28)		
$TAX_i \cdot \Delta Log(corporate\ CDS)_{ijt}$					0.115	0.261***
					(1.04)	(3.23)
$\Delta Log(stock\ index)_{jt}$	-0.460***	-0.479***	-0.506***	-0.484***	-0.511***	-0.493***
	(-19.14)	(-20.23)	(-14.90)	(-19.81)	(-15.85)	(-19.13)
$\Delta Log(commodity\ price)_{jt}$	-0.081***	-0.084***	-0.090***	-0.080***	-0.091***	-0.090***
	(-6.10)	(-6.37)	(-5.60)	(-5.91)	(-5.72)	(-6.28)
$\Delta Log(exchange\ rate)_{jt}$	0.231***	0.242***	0.263***	0.237***	0.267***	0.257***
	(8.11)	(8.41)	(7.09)	(8.21)	(7.55)	(8.32)
Country FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	9,107	9,107	9,107	9,107	9,107	9,107

Note: columns (1) and (2) interact corporate CDS with *ASST*, which is a dummy for whether the corporation has total assets higher than 50^{th} and 75^{th} percentile of its country level, respectively; columns (3) - (4) and columns (5) – (6) do similar interactions with *LIAB* and *TAX*, respectively. T statistics are reported in parentheses. Standard errors are "Newey-West" heteroskedastic- and autocorrelation-consistent (HAC) standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Specification with News Dummy. Besides using a high-frequency event-study which only includes dates with corporate news releases, I also conduct an alternative specification to Equation 1. I create an indicator variable NEWS that equals one on a date with a news release and zero otherwise, and interact it with the change of corporate CDS rates:

$$\Delta Log(sovereign\ CDS)_{jt} = \alpha_j + \delta_t + \beta \Delta Log(corporate\ CDS)_{ijt} \quad \text{Equation 7}$$
$$+\eta \cdot NEWS_t \cdot \Delta Log(corporate\ CDS)_{ijt}$$
$$+\theta \Delta Log(X_{jt}) + \epsilon_{ijt}$$

where *i*, *j*, and *t* denote corporate, sovereign, and time on a daily basis, respectively.

The regression includes observations for all days but focuses on the correlation between sovereign and corporate CDS on days with news releases. In this case, β would measure the correlation between sovereign and corporate CDS on a typical day without a corporate news release; and η would be the coefficient of interest, measuring the extra correlation between sovereign and corporate CDS on a day with a corporate news release. This specification allows me to contrast the "causal" effect of corporate CDS on sovereign CDS on dates with news releases with the "noncausal" baseline correlation between the two variables on other dates. This specification would give my estimates a natural difference-in-difference interpretation. Table 9 reports the estimation results. The interaction term coefficients are positive and significant at the 1-percent level, consistent with the results in the high-frequency event study analysis. Table A.10 reports the estimation results with standardized beta coefficients and with all channels included. The coefficient on triple interaction term of SOE is significantly positive at 1-percent level, confirming again the prominent role of state ownership.

Table 9: Regression Results with News Dummy

Dependent variable: $\Delta Log(sovereign\ CDS)_{jt}$

Independent variable	(2)	(4)	(6)	(8)
$\Delta Log(corporate\ CDS)_{ijt}$	0.227***	0.219***	0.213***	0.206***
	(9.20)	(7.66)	(7.63)	(7.60)
$\Delta Log(corporate\ CDS)_{ijt} * NEWS$	0.105***	0.095***	0.093***	0.091***
	(14.19)	(13.29)	(13.30)	(13.42)
$\Delta Log(stock\ index)_{jt}$		-0.676***	-0.651***	-0.620***
		(-36.08)	(-34.96)	(-35.60)
$\Delta Log(commodity\ price)_{jt}$			-0.142***	-0.135***
			(-11.86)	(-12.13)
$\Delta Log(exchange\ rate)_{jt}$				0.431***
				(16.16)
Country FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Observations	35,734	29,743	29,743	29,743

Note: *t* statistics are reported in parentheses. Standard errors are "Newey-West" heteroskedastic- and autocorrelation-consistent (HAC) standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Two-day Event Window. Sometimes market players act before the formal release of news recorded in Factiva. This phenomenon may be because some news outlets have more timely reporting of corporate news. For example, *www.upstreamonline.com* is a website that has the timeliest reporting of oil companies. Time zone differences can also lead to market players on some continents act faster than others. To consider such an effect, I use a two-day event window to check my results' robustness. This time frame is also used in Hébert and Schreger (2017). Consider a news release at 2pm EDT on Wednesday, November 9, 2016. The two-day event window, applied to this event, would use the CDS rate change from the close on Monday, November 7, to the close on Wednesday, November 9th. For this specification, two-day windows are applied to all variables. Table 10 reports the

baseline regression results using one-day and two-day event-windows side by side. Two sets of results are qualitatively and quantitatively similar, indicating that there is evidence for such a market anticipation effect. Results on three transmission channels are reported in Table A.11 - A.13 in the Appendix.

Falsification Test. Suppose changes in corporate CDS rates drive variation in sovereign CDS rates only on the day of the news release. In that case, I should not observe a significant impact of corporate CDS changes on lagged sovereign CDS changes. Table 11 reports the baseline regression results using sovereign CDS changes and lagged sovereign CDS changes side by side. While the coefficients of corporate CDS are still statistically significant, the magnitudes are only about one-third the size. Table A.14 - A.16 in the Appendix report the regression results for this falsification test for three channels. For the fiscal channel tests, the coefficients on corporate CDS rates are much smaller than those reported in the main results. At the same time, the state ownership and government-dependent sector interaction terms are no longer statistically significant. For tests of the size channel, the coefficient of corporate CDS rates is no longer statistically significant. Although the coefficients of the three interaction terms are still statistically significant, their magnitudes are much smaller. For tests of the financial channel, the coefficients of bank CDS rates are no longer statistically significant.

Table 10: Two-day Event Window Results - Baseline Regression

Dependent variable: $Log(sovereign\ CDS)_{ij,t} - Log(sovereign\ CDS)_{ij,t-2}$

	one-day window	two-day window	one-day window	two-day window	one-day window	two-day window	one-day window	two-day window
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta Log(corporate\ CDS)_{ijt}$	0.335***	0.380***	0.307***	0.355***	0.303***	0.326***	0.297***	0.317***
	(5.58)	(5.41)	(4.97)	(4.74)	(4.97)	(4.68)	(4.95)	(4.95)
$\Delta Log(stock\ index)_{jt}$			-0.542***	-0.610***	-0.529***	-0.590***	-0.513***	-0.561***
			(-16.96)	(-15.58)	(-16.76)	(-15.41)	(-17.01)	(-15.73)
$\Delta Log(commodity\ price)_{jt}$					-0.096***	-0.121***	-0.093***	-0.112***
					(-5.81)	(-7.52)	(-6.06)	(-7.54)
$\Delta Log(exchange\ rate)_{jt}$							0.268***	0.346***
							(7.90)	(6.66)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	10,201	10,188	9,107	9,020	9,107	9,020	9,107	9,020

Note: columns (1), (3), (5), and (7) report baseline regression results using a one-day event window. Columns (2), (4), (6), and (8) report baseline regression results using a two-day event window. T statistics are reported in parentheses. Standard errors are "Newey-West" heteroskedastic- and autocorrelation-consistent (HAC) standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table 11: Falsification Test Results - Baseline Regression

	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta Log(corporate\ CDS)_{ijt}$	0.335***	0.092**	0.307***	0.090**	0.303***	0.090**	0.297***	0.079**
	(5.58)	(2.44)	(4.97)	(2.18)	(4.97)	(2.18)	(4.95)	(2.13)
$\Delta Log(stock\ index)_{jt}$			-0.542***	-0.098***	-0.529***	-0.100***	-0.513***	-0.065**
			(-16.96)	(-3.19)	(-16.76)	(-3.24)	(-17.01)	(-2.11)
$\Delta Log(commodity\ price)_{jt}$					-0.096***	-0.009	-0.093***	0.012
					(-5.81)	(-0.52)	(-6.06)	(0.76)
$\Delta Log(exchange\ rate)_{jt}$							0.268***	0.526***
							(7.90)	(7.20)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	10,201	5,023	9,107	4,680	9,107	4,680	9,107	4,680

Note: columns (1), (3), (5), and (7) report baseline regression results using $\Delta Log(SCDS)_{j,t}$ as the dependent variable. Columns (2), (4), (6), and (8) report baseline regression results using $\Delta Log(SCDS)_{j,t-1}$ as the dependent variable. T statistics are reported in parentheses. Standard errors are "Newey-West" heteroskedastic- and autocorrelation-consistent (HAC) standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

4 Extreme Value Analysis: The Effects of Changes in Corporate Risk on Sovereign Risk

To capture the spillover from corporate to sovereign risk, I use a form of extreme value analysis, as described in Forbes (2013), to examine the incidence and patterns in extreme changes in corporate CDS rates over time. More specifically, I identify the dates from January 2014 to December 2016 when each corporate has an extreme-positive or extreme-negative change in CDS rates, defined as a change in the top or bottom 5^{th} or 1^{st} percentile of the distribution of that corporation's changes in CDS rates. If extreme changes in corporate CDS rates have no impact on their sovereign, then there should be roughly a 5 or 1 percent possibility that the sovereign should experience extreme changes in CDS rates on the same day. However, if extreme changes in sovereign CDS rates are more likely when a corporation has extreme CDS changes, it would suggest either spillovers or common shocks. Although this exercise cannot determine the direction of causality from corporate to sovereign, it can show the extent of co-movement.

4.1 Methodology

I estimate the conditional probability that a sovereign has an extreme change in its CDS rate on any day as a function of its corporate and bank counterparts, also having an extreme change in their CDS rates, as well as global shocks. The method helps disentangle the effect of global shocks from linkages between corporations and sovereigns. I include different observable global shocks at a daily frequency: the change in the commodity price relevant to the corporate, the change in the VIX as a

proxy for global financial volatility, and the US repo rate and TED spread. The formal specification is:

$$Prob\left(EC_{it}^{S}=1\right)=F(\alpha_{it}+\beta\cdot Global_{t}+\gamma\cdot EC_{it}^{C}+\zeta\cdot EC_{it}^{B}) \qquad \text{Equation 8}$$

where EC_{it}^{S} is a dummy equal to 1 if sovereign *i* experiences an extreme change (positive or negative) in its CDS rate on day *t*, EC_{it}^{C} is a dummy equal to 1 if the corporation associated with sovereign *i* experiences an extreme change in its CDS rate on day *t*, and EC_{it}^{B} is a dummy equal to 1 if the average bank CDS rates associated with sovereign *i* experience an extreme change on day *t*. *Global* measures global shocks on day *t*.

Following Forbes (2013), the appropriate methodology to estimate Equation 8 is determined by the cumulative distribution function of $(\alpha_{it}+\beta\cdot Global_{t}+\gamma\cdot EC_{it}^{C}+\zeta\cdot EC_{it}^{B})$, $F(\cdot)$. Because extreme changes in CDS rates occur irregularly, $F(\cdot)$ is asymmetric. Therefore, I estimate Equation 8 using the complementary logarithmic (or cloglog) framework, which assumes that $F(z)=1-\exp\{-\exp(z)\}$ is the cumulative distribution function of the extreme value distribution. This distribution fits maximum likelihood models with dichotomous dependent variables coded as 0/1. I also cluster standard errors by country.

4.2 Data and Summary Statistics

The sample includes CDS data available in Markit from 1/1/2014 to 12/29/2016. The corporations and banks covered are the same as those listed in Table A.2 and Table A.3. To mitigate the effect of sovereign-bank linkages, I control for dates with extreme values for bank CDS rate changes in each regression. Event dates with news releases

on sovereign credit ratings are excluded, resulting in 2,300 observations being dropped from the sample. Table 12 and Table 13 tabulate the incidence of extreme changes in both corporate and sovereign CDS rates for each country in the sample at the 5^{th}-percentile and 1^{st}-percentile thresholds, respectively.

The coincidence of extreme CDS changes is only a rough proxy for spillovers from corporate to sovereign risk. The spillovers could run in the opposite direction; alternatively, the two sectors could experience substantial changes in risk simultaneously due to a global shock, such as commodity prices or U.S. monetary policy. To control the effects of global shocks, I include a set of global variables in the regression. Global shocks are measured in absolute values since they are not expected to have linear effects. Table 14 reports descriptive statistics for measures of global shocks expressed in absolute values.

Table 12: Incidence of Extreme Changes in Corporate and Sovereign CDS Rates (5^{th}-percentile Threshold)

Dummy=1 if corporate experiences extreme change	Dummy=1 if sovereign experiences extreme change		
Brazil	0	1	Total
0	4,871	343	5,214
1	341	249	590
Total	5,212	592	5,804
Chile	0	1	Total
0	4,871	343	5,214
1	341	249	590
Total	5,212	592	5,804
China	0	1	Total
0	3,278	253	3,531
1	253	147	400
Total	3,531	400	3,931
Malaysia	0	1	Total
0	3,756	146	3,902
1	146	296	442
Total	3,902	442	4,344
Mexico	0	1	Total
0	3,916	260	4,176
1	260	214	474
Total	4,176	474	4,650
Philippines	0	1	Total
0	1,548	156	1,704
1	156	40	196
Total	1,704	196	1,900
Russia	0	1	Total
0	5,427	295	5,722
1	295	351	646
Total	5,722	646	6,368
South Africa	0	1	Total
0	2,498	194	2,692
1	194	108	302
Total	2,692	302	2,994
Thailand	0	1	Total
0	2,508	190	2,698
1	190	114	304
Total	2,698	304	3,002

Source: Markit.

Table 13: Incidence of Extreme Changes in Corporate and Sovereign CDS Rates (1^{st}-percentile Threshold)

Dummy=1 if corporate experiences extreme change	Dummy=1 if sovereign experiences extreme change		
Brazil	0	1	Total
0	5,573	105	5,678
1	105	21	126
Total	5,678	126	5,804
Chile	0	1	Total
0	3,768	74	3,842
1	74	10	84
Total	3,842	84	3,926
China	0	1	Total
0	3,782	65	3,847
1	65	19	84
Total	3,847	84	3,931
Malaysia	0	1	Total
0	4,219	35	4,254
1	35	55	90
Total	4,254	90	4,344
Mexico	0	1	Total
0	4,488	62	4,550
1	62	38	100
Total	4,550	100	4,650
Philippines	0	1	Total
0	1,825	35	1,860
1	35	5	40
Total	1,860	40	1,900
Russia	0	1	Total
0	6,156	70	6,226
1	70	72	142
Total	6,226	142	6,368
South Africa	0	1	Total
0	2,881	49	2,930
1	49	15	64
Total	2,930	64	2,994
Thailand	0	1	Total
0	2,892	46	2,938
1	46	18	64
Total	2,938	64	3,002

Source: Markit.

Table 14: Summary Statistics for Measures of Global Shocks (1/1/2014-12/29/2016)

	Obs.	Mean	St. Dev.	Min	Median	Max.	Skew.	Kurt.
Daily change in Commodity Price	34,630	2.114	10.28	0.000	0.660	320.5	12.81	214.0
Daily change in TED Spread	34,630	1.364	1.872	0.000	1.000	28.00	3.496	22.49
Daily change in US Repo Rate	34,630	0.004	0.016	0.000	0.000	0.190	7.329	71.85
Daily change in VIX	32,426	1.067	1.241	0.000	0.720	14.64	3.570	24.42

Source: Thomson Reuters Datastream and the Chicago Board Options Exchange.

4.3 Discussion of Main Results

Table 15 reports regression results including only extreme changes in corporate and bank CDS rates and then including different combinations of controls for global shocks. For each specification, the estimates show that an extreme change in a corporate CDS rate is significantly and positively correlated with the probability of observing an extreme change in the associated sovereign CDS rate on that day. The coefficients indicate that the latter possibility increases by a factor of about 5.5 (i.e., $exp(1.872)$-1). These results are robust to controlling for global shocks, suggesting that much of this joint coincidence results from contagion between corporations and their sovereigns or local shocks. The effects are even more substantial (by a factor of 16.7) when extreme values are defined using the 1st percentile instead of the 5th percentile as the threshold (see Table 16). Results for regressions with extreme values for bank CDS excluded are similar and are available in Table A.17 and Table A.18.

Similar to our high-frequency event-study analysis, I test the three possible transmission channels. For the fiscal channel, Table 17 shows that the additional correlation between extreme changes in corporate and sovereign CDS rates associated

with SOEs is statistically significant no matter which cutoff is used to define SOEs. SOEs and their sovereigns are especially likely to experience extreme changes in CDS rates at the same time. This result is more robust to the SOE threshold definition than the comparable result from the high-frequency event-study analysis. Meanwhile, the extra correlation from corporations operating in "government-dependent" sectors is only statistically significant when I use the 75th percentile as the cutoff to define the *GOV* dummy, not the 50th percentile. For the size channel, Table 18 shows that extreme changes in CDS rates of corporations with total liabilities above the 75th percentile have an extra correlation with extreme changes in CDS rates of their sovereigns. When I define the size dummy by total assets and corporate income tax payments, the coefficients are weakly or not statistically significant. Table 19 shows that the bank stress interaction term's coefficient is not significant for the financial channel. It indicates that an extreme change in bank CDS rate when the country experiences financial market news releases does not contribute to more correlation with extreme changes in their sovereigns' CDS rates.

Table 15: Extreme Value Analysis - Results (5^{th}-percentile Threshold)

Dependent variable: a dummy=1 if the sovereign experiences an extreme change in CDS rate in day *t*

Independent variable	(1)	(2)	(3)	(4)	(5)
Dummy for corp. CDS extreme changes	1.989***	1.988***	1.963***	1.960***	1.872***
	(8.70)	(8.70)	(8.37)	(8.42)	(8.07)
Dummy for bank CDS extreme changes	1.192***	1.192***	1.162***	1.163***	1.138***
	(4.10)	(4.09)	(3.99)	(3.98)	(4.09)
Daily change in commodity price		0.003***	0.003***	0.003***	0.003***
		(5.72)	(5.84)	(5.74)	(6.46)
Daily change in TED spread			0.094***	0.094***	0.077***
			(6.55)	(6.73)	(5.12)
Daily change in US Repo rate				-8.641**	-7.351*
				(-2.17)	(-1.79)
Daily change in VIX					1.999***
					(8.15)
Observations	34,614	34,614	34,614	34,614	32,411

Note: standard error clustered at the country level and z statistics reported in parentheses. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table 16: Extreme Value Analysis - Results (1st-percentile Threshold)

Dependent variable: a dummy=1 if the sovereign experiences an extreme change in CDS rate in day *t*

Independent variable	(1)	(2)	(3)	(4)	(5)
Dummy for corp. CDS extreme changes	3.008***	3.004***	2.950***	2.948***	2.814***
	(12.13)	(12.08)	(11.35)	(11.83)	(10.89)
Dummy for bank CDS extreme changes	1.682***	1.686***	1.685***	1.721***	1.646***
	(5.72)	(5.69)	(6.06)	(6.45)	(6.51)
Daily change in commodity price		0.005***	0.005***	0.004***	0.005***
		(3.13)	(3.01)	(2.87)	(3.24)
Daily change in TED spread			0.090***	0.094***	0.058
			(2.60)	(2.66)	(1.60)
Daily change in US Repo rate				-29.69	-28.95*
				(-1.63)	(-1.66)
Daily change in VIX					0.175***
					(5.95)
Observations	34,614	34,614	34,614	34,614	32,411

Note: standard error clustered at the country level and z statistics reported in parentheses. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table 17: Extreme Value Analysis Results – Fiscal Channel (5^{th}-percentile Threshold)

Dependent variable: a dummy=1 if the sovereign experiences an extreme change in CDS rate in day *t*

	State Ownership (firm-level)				Gov. Dependence (sector-level)	
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for corp. CDS extreme changes	1.782***	1.840***	1.917***	1.913***	1.889***	1.912***
	(7.42)	(7.63)	(8.91)	(8.90)	(8.46)	(8.73)
Dummy for bank CDS extreme changes	1.183***	1.186***	1.186***	1.186***	1.192***	1.187***
	(4.14)	(4.15)	(4.16)	(4.15)	(4.23)	(4.17)
SOE_{30}·Dummy for corp. CDS extreme changes	0.356**					
	(2.28)					
SOE_{50}·Dummy for corp. CDS extreme changes		0.287**				
		(2.32)				
SOE_{80}·Dummy for corp. CDS extreme changes			0.220***			
			(2.77)			
SOE_{100}·Dummy for corp. CDS extreme changes				0.249***		
				(2.85)		
GOV_{50}·Dummy for corp. CDS extreme changes					0.192	
					(1.10)	
GOV_{75}·Dummy for corp. CDS extreme changes						0.442***
						(3.00)
Daily change in commodity price	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(3.01)	(2.99)	(3.26)	(3.30)	(3.46)	(3.27)
Daily change in TED spread	0.004	0.004	0.004	0.004	0.004	0.004
	(0.21)	(0.21)	(0.20)	(0.20)	(0.22)	(0.21)
Daily change in US Repo rate	-2.079	-2.082	-2.155	-2.150	-2.108	-2.062
	(-1.47)	(-1.48)	(-1.52)	(-1.53)	(-1.47)	(-1.39)
Daily change in VIX	-0.035**	-0.035**	-0.036**	-0.036**	-0.036**	-0.036**
	(-2.08)	(-2.08)	(-2.17)	(-2.16)	(-2.12)	(-2.15)
Observations	34,628	34,628	34,628	34,628	34,628	34,628

Note: columns (1) to (4) interact a dummy for corporate CDS extreme changes with different *SOE*, which is a dummy for whether the corporation has ultimate state ownership strictly higher than 30%, 50%, 80%, and wholly owned by the government (100%), respectively. Columns (5) and (6) interact a dummy for corporate CDS extreme changes with different *GOV*, which is a dummy for whether the corporation operates in a sector with a "government dependence" variable higher than 50^{th} and 75^{th} percentile among all sectors in its country. Standard error clustered at the country level and z statistics reported in parentheses. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table 18: Extreme Value Analysis Results – Size Channel (5^{th}-percentile Threshold)

Dependent variable: a dummy=1 if the sovereign experiences an extreme change in CDS rate in day *t*

	Total Assets	Total Liabilities	Taxation
Independent variable	(1)	(2)	(3)
Dummy for corp. CDS extreme changes	1.842***	1.822***	1.842***
	(8.89)	(8.93)	(9.63)
Dummy for bank CDS extreme changes	1.187***	1.187***	1.189***
	(4.15)	(4.16)	(4.18)
ASST · Dummy for corp. CDS extreme changes	0.279*		
	(1.94)		
LIAB · Dummy for corp. CDS extreme changes		0.293**	
		(2.30)	
TAX · Dummy for corp. CDS extreme changes			0.170
			(1.08)
Daily change in commodity price	0.003***	0.003***	0.003***
	(3.40)	(3.23)	(3.21)
Daily change in TED spread	0.005	0.005	0.004
	(0.24)	(0.22)	(0.21)
Daily change in US Repo rate	-2.043	-2.075	-2.031
	(-1.46)	(-1.49)	(-1.44)
Daily change in VIX	-0.035**	-0.035**	-0.035**
	(-2.08)	(-2.08)	(-2.09)
Observations	34,628	34,628	34,628

Note: columns (1) interacts a dummy for corporate CDS extreme changes with ASST, which is a dummy for whether the corporation has total asset higher than the 75^{th} percentile of its country level; columns (2) interacts a dummy for corporate CDS extreme changes with LIAB, which is a dummy for whether the corporation has total liabilities higher than 75^{th} percentile of its country level; columns (3) interacts a dummy for corporate CDS extreme changes with TAX, which is a dummy for whether the corporation has total taxation higher than 75^{th} percentile of its country level. Standard error clustered at the country level and z statistics reported in parentheses. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table 19: Extreme Value Analysis Results - Financial Channel (5^{th}-percentile Threshold)

Dependent variable: a dummy=1 if the sovereign experiences an extreme change in CDS rate in day t

	Bank Stress Country-level
Independent variable	(1)
Dummy for corp. CDS extreme changes	1.906***
	(6.40)
BANK · Dummy for bank CDS extreme changes	0.102
	(0.41)
Dummy for bank CDS extreme changes	1.191***
	(4.18)
Daily change in commodity price	0.003***
	(3.41)
Daily change in TED spread	0.004
	(0.21)
Daily change in US Repo rate	-2.142
	(-1.47)
Daily change in VIX	-0.036**
	(-2.09)
Observations	34,628

Note: column (1) interacts a dummy for bank CDS extreme changes with *BANK*, which takes a value of one if country *j* on date *t* experiences a news release on any of the banks included in the sample and zero otherwise. Standard error clustered at the country level and z statistics reported in parentheses. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

5 Conclusion

In this paper, I examine the link between credit risks of corporations and those of their sovereigns. I construct a novel data set that combines corporate- and sovereign-level daily data on CDS rates and daily corporate news in 9 EMs from 1/1/2014 to 12/29/2016. Using this data set, I show that post-news changes in corporations' CDS rates have a significant impact on changes in sovereign CDS rates. I treat daily news

releases on corporate credit conditions as indicators of exogenous shocks and isolate the effect of corporate credit risk on sovereign credit risk by constructing a one-day event window around each news release. The results indicate that potential government bailouts or other spillovers from SOEs, government-dependent firms, and large corporations may elevate sovereign credit risk in emerging markets. Stress in the domestic banking sector also contributes to credit risk spillovers from corporations to sovereigns. Being an SOE has the most prominent effect among all channels.

Additionally, an extreme value analysis shows that extreme changes in sovereign CDS rates are more likely when SOEs, government-dependent firms, and large corporations in the same country also experience extreme changes in their CDS rates. These results are robust when I control for common global shocks and extreme changes in domestic bank CDS rates.

Overall, I consider the spillovers of credit risk from SOEs, government-dependent firms, and large corporations to sovereign credit risk in EMs as reflecting a significant cost of implicit government guarantees of private debt. I believe that incorporating the cost of such bailouts into measures of sovereign credit risk in EMs has critical implications for monitoring sovereign defaults and designing fiscal policies.

Appendix

Table A.1: Emerging Markets Sovereign Defaults (1999-2016)

Date	**Country**
May 25, 1999	Russia
October 22, 1999	Ecuador
February 25, 2009	Pakistan
March 21, 2000	Cote d'Ivoire
November 30, 2011	Argentina
June 13, 2002	Moldova
May 3, 2003	Uruguay
December 30, 2004	Grenada
April 20, 2005	Dominican Republic
December 7, 2006	Belize
October 23, 2008	Seychelles
December 16, 2008	Ecuador
January 31, 2011	Cote d'Ivoire
September 20, 2012	Belize
March 15, 2013	Grenada
July 30, 2014	Argentina
September 23, 2015	Ukraine

Table A.2: List of Corporates in the Sample

Firm	Headquarter	Sector	% of Direct State Ownership	% of Ultimate State Ownership	No. of Events	Total Assets/Country's GDP (%)
Ambev	Brazil	Consumer Goods	0.0	0.0	88	1.2
Braskem	Brazil	Basic Materials	0.0	28.3	236	0.8
CSN	Brazil	Basic Materials	0.0	0.0	147	0.7
Embraer	Brazil	Industrials	0.0	50.1	174	0.6
Gerdau	Brazil	Basic Materials	0.0	0.0	138	0.9
JBS	Brazil	Consumer Goods	0.0	0.0	308	1.5
Petrobras	Brazil	Energy	60.1	60.1	617	12.4
Usiminas	Brazil	Basic Materials	0.0	0.0	98	0.4
Vale	Brazil	Basic Materials	6.5	50.1	434	4.7
Arauco	Chile	Basic Materials	0.0	0.0	52	5.5
CAP	Chile	Basic Materials	0.0	0.0	33	2.3
Codelco	Chile	Basic Materials	100.0	100.0	162	13.5
ENAP	Chile	Energy	100.0	100.0	107	2.2
Enel Generacion Chile	Chile	Utilities	0.0	0.0	86	3.6
Sociedad Química y Minera	Chile	Basic Materials	0.0	0.0	51	1.8
Transelec	Chile	Energy	0.0	0.0	26	1.5
China Comms. Construction	China	Industrials	88.0	88.0	37	1.0
China Mobile	China	Telecommunications	72.7	72.7	67	1.9
China Resources Enterprise	China	Industrials	51.9	51.9	98	0.2
China Unicom HK	China	Telecommunications	33.8	33.8	110	0.8

CITIC Pacific	China	Industrials	58.0	58.0	163	7.9
CNOOC	China	Energy	64.4	64.4	128	0.9
Sinopec	China	Energy	75.8	75.8	381	2.0
Genting	Malaysia	Consumer Services	0.0	0.0	188	6.6
IOI Corporation	Malaysia	Consumer Goods	0.0	0.0	69	1.3
MISC	Malaysia	Industrials	65.0	73.8	75	3.8
Petronas	Malaysia	Energy	100.0	100.0	164	44.5
Telekom Malaysia	Malaysia	Telecommunications	28.0	28.0	133	1.9
Tenaga Nasional	Malaysia	Utilities	41.8	41.8	218	10.2
YTL Corp	Malaysia	Utilities	0.0	0.0	10	5.7
América Móvil	Mexico	Telecommunications	0.0	0.0	305	6.2
Cemex	Mexico	Consumer Goods	0.0	0.0	125	2.6
Federal Electricity Commission	Mexico	Utilities	100.0	100.0	131	6.3
Grupo Bimbo	Mexico	Consumer Goods	0.0	0.0	17	1.0
Grupo Televisa	Mexico	Telecommunications	0.0	0.0	80	1.2
Pemex	Mexico	Energy	100.0	100.0	408	9.9
Telefonos De Mexico	Mexico	Telecommunications	0.0	0.0	38	0.5
JG Summit Holdings	Philippines	Consumer Services	0.0	0.0	40	4.2
National Power Corporation	Philippines	Utilities	100.0	100.0	30	0.3
PLDT	Philippines	Telecommunications	0.0	0.0	230	3.0
San Miguel Corporation	Philippines	Utilities	0.0	0.0	105	8.6
Alrosa	Russia	Basic Materials	44.0	77.0	247	0.4
Gazprom	Russia	Energy	38.4	50.2	713	16.4

Gazprom Neft	Russia	Energy	0.0	48.1	274	2.4
Russian Railways	Russia	Industrials	100.0	100.0	500	6.6
Lukoil	Russia	Energy	0.0	0.0	413	5.6
Mobile Telesystems	Russia	Telecommunications	0.0	0.0	274	0.6
Rosneft	Russia	Energy	50.1	50.1	646	9.8
Severstal	Russia	Basic Materials	0.0	0.0	256	0.4
Sistema	Russia	Telecommunications	0.0	0.0	272	1.2
Transneft	Russia	Energy	100.0	100.0	367	2.6
AngloGold Ashanti	South Africa	Basic Materials	0.0	0.0	177	2.4
Eskom Holdings	South Africa	Utilities	100.0	100.0	152	14.4
Sappi	South Africa	Basic Materials	0.0	0.0	48	1.6
Sasol	South Africa	Energy	12.3	25.8	124	8.2
Transnet	South Africa	Industrials	100.0	100.0	44	8.9
PTT Global Chemical	Thailand	Basic Materials	0.0	25.9	98	2.8
PTT Exploration & Production	Thailand	Energy	0.0	34.8	125	5.0
PTT Public Company	Thailand	Energy	51.1	52.5	115	14.4
Thai Oil	Thailand	Energy	0.0	26.1	47	1.4
True Company	Thailand	Telecommunications	0.0	0.0	35	2.2

Note: the last column reports each corporation's total assets as a share of its headquarter's GDP, an average of 2014 to 2016. Data on corporations' total assets are from Worldscope and corporations' websites. Data on countries' GDP are from the World Bank's World Development Indicators.

Table A.3: List of Banks in the Sample

Bank	Headquarter	% of Direct State Ownership
Banco BMG	Brazil	0.0
Banco Bradesco	Brazil	0.0
Banco Do Brasil	Brazil	96.9
Banco Panamericano	Brazil	0.0
Banco Votorantim	Brazil	0.0
Itaú Unibanco	Brazil	0.0
Banco de Chile	Chile	0.0
Banco Santander - Chile	Chile	0.0
Agricultural Bank of China	China	79.2
Bank of China	China	67.6
Bank of Communications	China	26.5
China CITIC Bank International (CNCBI)	China	0.0
China Construction Bank	China	57.0
China Everbright Bank	China	22.0
China Merchants Bank	China	12.4
Industrial and Commercial Bank of China	China	70.7
Shanghai Pudong Development Bank	China	0.0
AmBank	Malaysia	0.0
CIMB Bank Malaysia	Malaysia	28.1
Hong Leong Bank	Malaysia	0.0
Malayan Banking Berhad (Maybank)	Malaysia	0.0
Public Bank Berhad	Malaysia	0.0
RHB Bank Berhad	Malaysia	0.0
BBVA Bancomer	Mexico	0.0
Banco Mercantil del Norte	Mexico	0.0
Nacional Financiera	Mexico	0.0
BDO Unibank	Philippines	0.0
Land Bank of the Philippines	Philippines	100.0
Metropolitan Bank and Trust Company	Philippines	0.0
Rizal Commercial Banking Corporation	Philippines	0.0
Alfa-Bank	Russia	0.0
Bank of Moscow	Russia	44.0
Bank Otkritie Financial Corporation	Russia	0.0
Gazprombank	Russia	0.0
Home Credit and Finance Bank	Russia	0.0
MDM Bank	Russia	0.0
Promsvyazbank	Russia	0.0
Russian Agricultural Bank	Russia	100.0
Russian Standard Bank	Russia	0.0
Sberbank of Russia	Russia	57.6

TransCreditBank	Russia	0.0
Uralsib Bank	Russia	0.0
Vnesheconombank (VEB)	Russia	100.0
VTB Bank	Russia	80.5
Zenit Bank	Russia	0.0
FirstRand Bank	South Africa	0.0
Standard Bank of South Africa	South Africa	0.0
Bangkok Bank	Thailand	0.0
Export-Import Bank of Thailand	Thailand	100.0
Kasikornbank	Thailand	0.0
Krung Thai Bank	Thailand	55.1
Siam Commercial Bank	Thailand	23.7
TMB Bank	Thailand	26.1

Table A.4: Summary Statistics for the Variables in High-frequency Event-study Analysis, Including All Dates

	Obs.	Mean	St. Dev.	Min.	Median	Max.	Skew.	Kurt.
Whole Sample								
$\Delta Log(corporate\ CDS)$	35734	-0.002	0.041	-1.716	-0.001	0.832	-4.728	171.3
$\Delta Log(sovereign\ CDS)$	35734	0.003	0.030	-0.210	0.002	0.192	0.129	5.977
$\Delta Log(stock\ index)$	29743	0.000	0.015	-0.112	0.000	0.129	0.100	9.523
$\Delta Log(commodity\ price)$	35734	-0.001	0.029	-0.847	0.000	0.747	-3.749	160.0
$\Delta Log(exchange\ rate)$	35734	0.000	0.010	-0.129	0.000	0.147	0.422	27.04
Brazil								
$\Delta Log(corporate\ CDS)$	5451	-0.003	0.049	-0.955	-0.001	0.832	-4.828	129.7
$\Delta Log(sovereign\ CDS)$	5451	0.003	0.031	-0.133	0.003	0.138	0.069	5.135
Chile								
$\Delta Log(corporate\ CDS)$	3814	-0.002	0.025	-0.455	-0.000	0.348	-4.994	125.3
$\Delta Log(sovereign\ CDS)$	3814	0.006	0.032	-0.152	0.005	0.160	-0.023	5.775
China								
$\Delta Log(corporate\ CDS)$	3654	-0.003	0.048	-1.716	-0.000	0.677	-12.61	466.1
$\Delta Log(sovereign\ CDS)$	3654	0.004	0.024	-0.079	0.003	0.116	0.418	4.630
Malaysia								
$\Delta Log(corporate\ CDS)$	4282	-0.001	0.030	-0.133	-0.003	0.185	0.805	6.292
$\Delta Log(sovereign\ CDS)$	4282	0.002	0.029	-0.096	0.000	0.162	0.462	5.040
Mexico								
$\Delta Log(corporate\ CDS)$	4497	-0.001	0.029	-0.640	-0.001	0.214	-3.278	77.06
$\Delta Log(sovereign\ CDS)$	4497	0.003	0.033	-0.210	0.002	0.147	-0.200	6.471
Philippines								
$\Delta Log(corporate\ CDS)$	1852	-0.010	0.086	-0.503	-0.002	0.573	-0.821	18.03
$\Delta Log(sovereign\ CDS)$	1852	0.003	0.024	-0.092	0.002	0.096	0.306	4.213
Russia								
$\Delta Log(corporate\ CDS)$	6279	-0.001	0.030	-0.462	-0.000	0.410	-0.065	29.86
$\Delta Log(sovereign\ CDS)$	6279	0.002	0.035	-0.163	0.004	0.192	0.088	5.618
South Africa								
$\Delta Log(corporate\ CDS)$	2946	-0.003	0.044	-0.817	-0.001	0.519	-5.507	110.3
$\Delta Log(sovereign\ CDS)$	2946	0.003	0.025	-0.116	0.002	0.150	0.337	5.616
Thailand								
$\Delta Log(corporate\ CDS)$	2959	-0.003	0.029	-0.218	-0.000	0.257	0.038	13.74
$\Delta Log(sovereign\ CDS)$	2959	0.002	0.023	-0.073	0.001	0.125	0.723	6.252

Note: CDS data cover all trading dates from 1/1/2014 to 12/29/2016. $\Delta Log(corporate\ CDS)$ and $\Delta Log(sovereign\ CDS)$ are the daily log change in corporate CDS rates and sovereign CDS rates, respectively. $\Delta Log(stock\ index)$ is the daily log change in the close price of a country's major stock index. $\Delta Log(commodity\ price)$ is the daily log change in the relevant commodity price associated with each corporation. $\Delta Log(exchange\ rate)$ is the daily log change in the country's foreign exchange rate against the US dollar.

Source: CDS data are from Markit. Stock index data are from Bloomberg. Commodity prices and exchange rates are from Thomas Reuters Datastream.

Table A.5: Selected Government Bailout/Guarantee of SOEs

Country	Company	Year	Detail
Brazil	Petrobras	2016	Brazilian President Dilma Rousse said her government is willing to bailout Petrobras, the state-run oil company, if the oil prices continue to decline.
Chile	Codelco	2016	Chilean government announced a capital injection of USD975 million for the company in December 2016.
Chile	ENAP	2013	Chilean government approved a payment of up to USD60 million in 2013. Past government support included "a temporary capitalization of retained earnings at ENAPs subsidiaries in both 2008 and 2009, temporary suspension of tax payments in 2009, capitalization of profits between 2009 and 2011, and a USD250 million equity injection in 2008".[14]
China	BOC, CBC	2004	China announced a USD45 billion bailout of 2 state-owned Banks, intending to help control fraud and limit bad loans.
Malaysia	Malaysian Airline	2014	The nation's state investment firm, which controls nearly 70% of Malaysian Airline, disclosed a USD430 million plan to restore the airline's financial strength.
Malaysia	Felda	2019	Malaysia announced an RM6.23 billion financial aid for state-owned national land development agency Felda to revive the indebted organization.
Mexico	Pemex	2016	Years of losses have left Pemex with substantial unfunded pension liabilities and on the hook for billions to suppliers. The Mexican government had to come to the rescue with USD4.4 billion in aid.
Mexico	Pemex	2019	Mexico injected USD3.9 billion into ailing Pemex, promising to strengthen its finances and prevent a further credit downgrade.
Russia	Russian Railways	2016	Government support for Russian Railways from all budgets totaled RUB 94.9 billion in 2016, including federal budget subsidies of RUB 93.6 billion.
South Africa	Eskom	2019	South Africa's government brought forward Eskom's bailout after the company rushed 5 billion rand (USD355 million) to the struggling utility earlier to avert a default and said more cash could be needed soon.

Source: major news outlets, reports from credit rating agencies, and companies' websites.

[14] See Fitch's report.

Table A.6: Summary Statistics for "Government Dependent" Variable

	Obs.	Mean	St. Dev.	Min.	Median	Max.
Brazil	17	0.042	0.020	0.012	0.038	0.095
Chile	17	0.028	0.017	0.000	0.028	0.054
China	17	0.024	0.008	0.011	0.025	0.041
Malaysia	17	0.012	0.007	0.004	0.012	0.032
Mexico	17	0.057	0.035	0.014	0.046	0.131
Philippines	17	0.036	0.019	0.000	0.036	0.071
Russia	17	0.049	0.018	0.022	0.048	0.088
South Africa	17	0.044	0.027	0.000	0.043	0.106
Thailand	17	0.030	0.018	0.008	0.022	0.067

Note: the "Government Dependent" variable at the sector level is the number of news articles having "Government Contracts" or "Regulation/Government Policy" as a topic, as a percentage of the total news articles for that sector.
Source: Factiva and the author's calculation.

Table A.7: Government Dependent Sectors

Country	**Sector**	**Country**	**Sector**
Brazil	Health Care/Life Sciences	Chile	Real Estate/Construction
	Business/Consumer Services		Health Care/Life Sciences
	Technology		Leisure/Arts/Hospitality
	Media/Entertainment		Technology
China	Financial Services	Malaysia	Financial Services
	Automotive		Energy
	Telecommunication Services		Media/Entertainment
	Agriculture		Business/Consumer Services
Mexico	Health Care/Life Sciences	Philippines	Industrial Goods
	Media/Entertainment		Utilities
	Telecommunication Services		Automotive
	Technology		Business/Consumer Services
Russia	Health Care/Life Sciences	South Africa	Telecommunication Services
	Media/Entertainment		Automotive
	Technology		Consumer Goods
	Utilities		Transportation/Logistics
Thailand	Agriculture		
	Media/Entertainment		
	Consumer Goods		
	Technology		

Source: Factiva and the author's calculation.

Table A.8: Summary Statistics for Financial-development Measures

	Obs.	Mean	St. Dev.	Min.	Median	Max.
DEP	27	1.182	0.722	0.244	0.994	2.758
CRE	24	0.787	0.183	0.440	0.823	0.980

Note: DEP is the ratio of the aggregate value of all bank deposits extended by banks to the private sector to the country's stock market capitalization. *CRE* is the ratio of bank credit to the private non-financial sector to total credit to the private non-financial sector.
Source: World Bank, BIS, and the author's calculation.

Table A.9: High-frequency Event-study Analysis - Financial Development

Dependent variable: $\Delta Log(sovereign\ CDS)_{jt}$

	Financial Development Country-level			
Independent variable	(1)	(2)	(3)	(4)
$\Delta Log(corporate\ CDS)_{ijt}$	0.630***	0.637***	1.067***	1.078***
	(5.43)	(5.61)	(3.28)	(3.28)
$DEP_j \cdot \Delta Log(corporate\ CDS)_{ijt}$	-0.178**	-0.182**		
	(-2.32)	(-2.41)		
$CRE_j \cdot \Delta Log(corporate\ CDS)_{ijt}$			-0.917***	-0.933***
			(-2.80)	(-2.81)
$\Delta Log(stock\ index)_{jt}$	-0.501***	-0.508***	-0.498***	-0.504***
	(-18.56)	(-18.94)	(-13.72)	(-14.16)
$\Delta Log(commodity\ price)_{jt}$	-0.088***	-0.088***	-0.086***	-0.086***
	(-6.22)	(-6.18)	(-5.47)	(-5.42)
$\Delta Log(exchange\ rate)_{jt}$	0.255***	0.252***	0.257***	0.254***
	(8.29)	(8.36)	(6.75)	(6.74)
Country/Sector FE	N	Y	N	Y
Time FE	Y	Y	Y	Y
Observations	8,988	8,988	8,753	8,753

Note: columns (1) and (2) report results where corporate CDS interacts with *DEP*, the ratio of the aggregate value of all bank deposits extended by banks to the private sector to the country's stock market capitalization. Columns (3) and (4) report results where corporate CDS interacts with *CRE*, the share of bank credit in total credit to the private non-financial sector. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.10: Alternative Specification with NEWS Dummy and Three Channels

Dependent variable: $Log(sovereign\ CDS)_{ij,t}$

Independent variable	(1)	(2)
$Log(corporate\ CDS)_{ij,t}$	0.231***	0.232***
	(5.83)	(5.84)
$Log(bank\ CDS)_{j,t}$	0.164***	0.164***
	(15.88)	(15.95)
$NEWS \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.105***	0.104***
	(17.34)	(17.32)
$SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.061***	0.060***
	(2.65)	(2.63)
$GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt}$	0.011	0.011
	(0.58)	(0.60)
$ASST_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.171***	0.172***
	(3.64)	(3.70)
$LIAB_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.002	0.000
	(0.05)	(0.00)
$TAX_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	-0.009	-0.008
	(-0.20)	(-0.19)
$BANK_{jt} \cdot \Delta Log(bank\ CDS)_{jt}$	0.014*	0.013*
	(1.89)	(1.87)
$NEWS \cdot SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.033***	0.033***
	(3.70)	(3.70)
$NEWS \cdot GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt}$	-0.004	-0.004
	(-0.25)	(-0.26)
$NEWS \cdot ASST_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.050	0.048
	(1.48)	(1.44)
$NEWS \cdot LIAB_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.033	0.034
	(1.03)	(1.08)
$NEWS \cdot TAX_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	-0.031	-0.032
	(-0.87)	(-0.90)
$NEWS \cdot BANK_{jt} \cdot \Delta Log(bank\ CDS)_{jt}$	-0.001	-0.001
	(-0.18)	(-0.14)
Controls not reported		
Country/Sector FE	N	Y
Time FE	Y	Y
Observations	26,036	26,036

Note: standard beta coefficients are reported. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.11: Two-day Event Window Results – Fiscal Channel

Dependent variable: $Log(sovereign\ CDS)_{ij,t} - Log(sovereign\ CDS)_{ij,t-2}$

	State Ownership		Gov. Dependence	
	one-day window	two-day window	one-day window	two-day window
Independent variable	(1)	(2)	(3)	(4)
$Log(corporate\ CDS)_{iqj,t} - Log(corporate\ CDS)_{iqj,t-2}$	0.268***	0.281***	0.288***	0.302***
	(4.60)	(4.31)	(4.68)	(4.50)
$SOE_i \cdot [Log(corporate\ CDS)_{iqj,t} - Log(corporate\ CDS)_{iqj,t-2}]$	0.352***	0.447***		
	(3.55)	(5.39)		
$GOV_{qj} \cdot [Log(corporate\ CDS)_{iqj,t} - Log(corporate\ CDS)_{iqj,t-2}]$			0.304**	0.446***
			(2.15)	(5.49)
$Log(stock\ index)_{j,t} - Log(stock\ index)_{j,t-2}$	-0.508***	-0.552***	-0.508***	-0.557***
	(-18.06)	(-17.09)	(-16.92)	(-16.33)
$Log(commodity\ price)_{j,t} - Log(commodity\ price)_{j,t-2}$	-0.088***	-0.103***	-0.090***	-0.107***
	(-6.02)	(-7.38)	(-5.83)	(-7.51)
$Log(exchange\ rate)_{j,t} - Log(exchange\ rate)_{j,t-2}$	0.253***	0.322***	0.264***	0.338***
	(7.98)	(6.83)	(7.99)	(6.83)
Country/Sector FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Observations	9,107	9,020	9,107	9,020

Note: columns (1) and (2) interact corporate CDS with SOE, which is a dummy for whether the corporation has 100% ultimate state ownership, and column (2) includes country fixed effects. Columns (3) and (4) interact corporate CDS with a dummy variable *GOV*, which takes a value of one if a corporation operates in a sector that has a "government dependence" value higher than the 75th percentile of sectors in the country sample, and zero otherwise. Columns (1) and (3) report regression results using a one-day event window. Columns (2) and (4) report regression results using a two-day event window. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.12: Two-day Event Window Results – Size Channel

Dependent variable: $Log(sovereign\ CDS)_{ij,t} - Log(sovereign\ CDS)_{ij,t-2}$

	Total Assets		Total Liabilities		Taxation	
	one-day window	two-day window	one-day window	two-day window	one-day window	two-day window
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
$Log(corporate\ CDS)_{ij,t} - Log(corporate\ CDS)_{ij,t-2}$	0.198***	0.205***	0.199***	0.209***	0.221***	0.236 ***
	(3.83)	(3.54)	(3.74)	(3.41)	(3.70)	(3.27)
$ASST_i \cdot [Log(corporate\ CDS)_{ij,t} - Log(corporate\ CDS)_{ij,t-2}]$	0.376***	0.431***				
	(6.04)	(6.80)				
$LIAB_i \cdot [Log(corporate\ CDS)_{ij,t} - Log(corporate\ CDS)_{ij,t-2}]$			0.352***	0.371***		
			(5.28)	(5.09)		
$TAX_i \cdot [Log(corporate\ CDS)_{ij,t} - Log(corporate\ CDS)_{ij,t-2}]$					0.261***	0.248***
					(3.23)	(2.89)
$Log(stock\ index)_{j,t} - Log(stock\ index)_{j,t-2}$	-0.479***	-0.516***	-0.484***	-0.527***	-0.493***	-0.538***
	(-20.23)	(-20.19)	(-19.81)	(-19.69)	(-19.13)	(-19.26)
$Log(commodity\ price)_{j,t} - Log(commodity\ price)_{j,t-2}$	-0.084***	-0.100***	-0.080***	-0.095***	-0.090***	-0.108***
	(-6.37)	(-8.07)	(-5.91)	(-7.17)	(-6.28)	(-7.95)
$Log(exchange\ rate)_{j,t} - Log(exchange\ rate)_{j,t-2}$	0.242***	0.296***	0.237***	0.297***	0.257***	0.330***
	(8.41)	(6.82)	(8.21)	(6.73)	(8.32)	(7.00)
Country FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	9,107	9,020	9,107	9,020	9,107	9,020

Note: columns (1) and (2) interact corporate CDS with *ASST*, a dummy for whether the corporation has total assets higher than 75th percentile of its country level; columns (3) and (4) interact corporate CDS with *LIAB*, a dummy for whether the corporation has total liabilities higher than 75th percentile of its country level; columns (5) and (6) interact corporate CDS with *TAX*, a dummy for whether the corporation has total taxation higher than 75th percentile of its country level. Columns (1), (3), and (5) report regression results using a one-day event window. Columns (2), (4), and (6) report regression results using a two-day event window. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.13: Two-day Event Window Results - Financial Channel

Dependent variable: $Log(sovereign\ CDS)_{ij,t} - Log(sovereign\ CDS)_{ij,t-2}$

	Bank Stress	
	one-day window	two-day window
Independent variable	(1)	(2)
$Log(corporate\ CDS)_{ij,t} - Log(corporate\ CDS)_{ij,t-2}$	0.293***	0.291***
	(4.66)	(4.46)
$BANK_{j,t-2} \cdot [Log(bank\ CDS)_{j,t} - Log(bank\ CDS)_{j,t-2}]$	0.046**	0.203***
	(2.12)	(4.37)
$Log(bank\ CDS)_{j,t} - Log(bank\ CDS)_{j,t-2}$	0.094***	0.149***
	(11.15)	(10.79)
$Log(stock\ index)_{j,t} - Log(stock\ index)_{j,t-2}$	-0.486***	-0.512***
	(-16.67)	(-16.15)
$Log(commodity\ price)_{j,t} - Log(commodity\ price)_{j,t-2}$	-0.090***	-0.108***
	(-5.98)	(-7.61)
$Log(exchange\ rate)_{j,t} - Log(exchange\ rate)_{j,t-2}$	0.255***	0.294***
	(7.81)	(6.26)
Country/Sector FE	Y	Y
Time FE	Y	Y
Observations	8,988	8,822

Note: columns (1) and (2) interact bank CDS with a dummy variable *BANK*, which takes a value of one if country *j* on date *t* experiences a news release on any of the banks included in the sample and zero otherwise. Column (1) reports regression results using a one-day event window. Column (2) reports regression results using a two-day event window. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.14: Falsification Test Results – Fiscal Channel

	State Ownership		Gov. Dependence	
	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$
Independent variable	(1)	(2)	(3)	(4)
$\Delta Log(corporate\ CDS)_{ijt}$	0.076**	0.074**	0.098***	0.092***
	(1.96)	(1.96)	(4.52)	(4.02)
$SOE_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.083	0.070		
	(1.30)	(1.13)		
$GOV_{qj} \cdot \Delta Log(corporate\ CDS)_{iqjt}$			-0.020	-0.016
			(-0.38)	(-0.32)
$\Delta Log(stock\ index)_{jt}$	-0.070**	-0.064**	-0.070**	-0.057*
	(-2.34)	(-2.12)	(-2.33)	(-1.79)
$\Delta Log(commodity\ price)_{jt}$	0.011	0.013	0.009	0.011
	(0.71)	(0.83)	(0.59)	(0.65)
$\Delta Log(exchange\ rate)_{jt}$	0.517***	0.525***	0.518***	0.521***
	(7.31)	(7.21)	(7.31)	(6.89)
Country FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Observations	4,680	4,680	4,680	4,680

Note: columns (1) and (2) interact corporate CDS with *SOE*, which is a dummy for whether the corporation has 100% ultimate state ownership, and column (2) includes country fixed effects. Columns (3) and (4) interact corporate CDS with a dummy variable *GOV*, which takes a value of one if a corporation operates in a sector that has a "government dependence" value higher than the 75th percentile of sectors in the country sample, and zero otherwise. Column (4) includes country and sector fixed effects. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.15: Falsification Test Results – Size Channel

	Total Assets		Total Liabilities		Taxation	
	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Log(corporate\ CDS)_{ijt}$	0.050	0.048	0.046	0.045	0.054	0.052
	(1.48)	(1.48)	(1.39)	(1.38)	(1.48)	(1.48)
$ASST_i \cdot \Delta Log(corporate\ CDS)_{ijt}$	0.126***	0.118***				
	(2.96)	(2.83)				
$LIAB_i \cdot \Delta Log(corporate\ CDS)_{ijt}$			0.123***	0.117***		
			(2.75)	(2.74)		
$TAX_i \cdot \Delta Log(corporate\ CDS)_{ijt}$					0.106**	0.101**
					(2.25)	(2.24)
$\Delta Log(stock\ index)_{jt}$	-0.056*	-0.051*	-0.059**	-0.054*	-0.062**	-0.057*
	(-1.93)	(-1.73)	(-2.02)	(-1.82)	(-2.13)	(-1.92)
$\Delta Log(commodity\ price)_{jt}$	0.013	0.015	0.013	0.015	0.012	0.014
	(0.87)	(0.98)	(0.88)	(1.00)	(0.78)	(0.92)
$\Delta Log(exchange\ rate)_{jt}$	0.507***	0.515***	0.507***	0.515***	0.515***	0.522***
	(7.26)	(7.16)	(7.26)	(7.17)	(7.29)	(7.19)
Country FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Observations	4,680	4,680	4,680	4,680	4,680	4,680

Note: columns (1) and (2) interact corporate CDS with *ASST*, which is a dummy for whether the corporation has total assets higher than 75th percentile of its country level; columns (3) and (4) interact corporate CDS with *LIAB*, which is a dummy for whether the corporation has total liabilities higher than 75th percentile of its country level; columns (5) and (6) interact corporate CDS with *TAX*, which is a dummy for whether the corporation has total taxation higher than 75th percentile of its country level. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.16: Falsification Test Results - Financial Channel

Dependent variable: $\Delta Log(sovereign\ CDS)_{j,t-1}$

	Bank Stress	
	$\Delta Log(SCDS)_{j,t}$	$\Delta Log(SCDS)_{j,t-1}$
Independent variable	(1)	(2)
$\Delta Log(corporate\ CDS)_{ijt}$	0.084**	0.080**
	(2.00)	(1.99)
$BANK_{jt} \cdot \Delta Log(bank\ CDS)_{jt}$	0.083***	0.085***
	(3.37)	(3.48)
$\Delta Log(bank\ CDS)_{jt}$	0.008	0.008
	(0.80)	(0.74)
$\Delta Log(stock\ index)_{jt}$	-0.063**	-0.056*
	(-2.08)	(-1.83)
$\Delta Log(commodity\ price)_{jt}$	0.011	0.013
	(0.74)	(0.84)
$\Delta Log(exchange\ rate)_{jt}$	0.513***	0.522***
	(7.25)	(7.17)
Country/Sector FE	Y	Y
Time FE	Y	Y
Observations	4,612	4,612

Note: columns (1) and (2) interact bank CDS with a dummy variable *BANK*, which takes a value of one if country *j* on date *t* experiences a news release on any of the banks included in the sample and zero otherwise. T statistics are reported in parentheses. Standard errors are "Newey-West" HAC standard errors. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.17: Extreme Value Analysis - Baseline Regression Results (5th-percentile Threshold, with Bank Extreme Values Excluded)

Dependent variable: a dummy=1 if the sovereign experiences an extreme change in CDS rate in day *t*

Independent variable	(1)	(2)	(3)	(4)	(5)
Dummy for corp. CDS extreme changes	2.039*** (10.07)	2.039*** (10.09)	2.003*** (9.69)	2.002*** (9.69)	1.930*** (9.25)
Daily change in commodity price		-0.001 (-1.02)	-0.001 (-0.93)	-0.001 (-0.94)	-0.002* (-1.37)
Daily change in TED spread			0.133*** (7.17)	0.133*** (7.22)	0.094*** (5.55)
Daily change in US Repo rate				-5.879 (-1.34)	-4.527 (-1.10)
Daily change in VIX					0.193*** (10.56)
Observations	31,083	31,083	31,083	31,083	29,049

Note: standard error clustered at the country level and z statistics reported in parentheses. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

Table A.18: Extreme Value Analysis - Baseline Regression Results (1st-percentile Threshold, with Bank Extreme Values Excluded)

Dependent variable: a dummy=1 if the sovereign experiences an extreme change in CDS rate in day *t*

Independent variable	(1)	(2)	(3)	(4)	(5)
Dummy for corp. CDS extreme changes	3.051*** (11.37)	3.046*** (11.33)	2.984*** (10.85)	2.983*** (10.82)	2.848*** (10.75)
Daily change in commodity price		0.005*** (3.13)	0.005*** (3.02)	0.005*** (2.93)	0.005*** (3.32)
Daily change in TED spread			0.088** (2.31)	0.088** (2.39)	0.057 (1.48)
Daily change in US Repo rate				-25.13 (-1.25)	-24.11 (-1.24)
Daily change in VIX					0.183*** (9.08)
Observations	33,858	33,858	33,858	33,858	33,858

Note: standard error clustered at the country level and z statistics reported in parentheses. *, ** and *** denote significance at 10 percent, 5 percent, and 1 percent, respectively.

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